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AN ENGINEERING STUDY OF SEWAGE DISPOSAL NEEDS FOR FEDERAL INSTALLATIONS AT MT. EDGECUMBE, ALASKA

CORNELL, HOWLAND, HAYES AND MERRYFIELD/PHILLEO
ENGINEERING AND ARCHITECTURAL SERVICE
CORVALLIS, OREGON

PREPARED FOR
PUBLIC HEALTH SERVICE, WASHINGTON, D.C.

FEBRUARY 1965

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OF

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PHILLEO ENGINEERING and ARCHITECTURAL SERVICE

and

CORNELL, HOWLAND, HAYES & MERRYFIELD

Engineers and Planners

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The most suitable method for collection and treatment of sewage discharged from the Mount Edgecumbe, Alaska, Federal Complex was determined. This engineering study includes data on the volume and character of liquid wastes, hospital practices affecting the sewage, availability and harvesting practices of shellfish and effects of the proposed discharge of treated effluent, and ocenographic characteristics of Sitka Sound and adjacent waters. Recreational, industrial, and other water uses are discussed with relation to the degree of treatment proposed. Economic and engineering factors involve the feasibility of collecting all wastes from existing multiple outfalls for treatment at one or more locations.

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10 February 1965

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Department of Health, Education,
and Welfare
Public Health Service
Bureau of State Services - EH
Division of Water Supply and
Pollution Control
Washington, D.C. 20201

Gentlemen: Contract No. PH 86-64-129

Transmitted herewith is our report on an engineering study of sewage collection and treatment facilities for the Mt. Edgecumbe, Alaska, Federal Complex. The principal findings and conclusions of the study are summarized as follows:

1. The population of the Mt. Edgecumbe Federal Complex is expected to increase to 2,500 by the year 1982, based primarily on enrollment increases anticipated at the Bureau of Indian Affairs School.

2. The City of Sitka is expected to increase in population at the rate of 4 percent per year compounded. A population of 8,000 is expected in 1982.

3. Primary treatment of the sewage from Mt. Edgecumbe and the City of Sitka will meet all regulatory agency treatment requirements.

4. Three different plans for collecting and treating the wastes were studied and detailed cost estimates were made for each plan.

5. Plan C using common sewage treatment facilities for treating the combined wastes from Mt. Edgecumbe and the City of Sitka is recommended provided discussion with the City of Sitka indicate such a program can be developed. The initial cost under this plan to the Mt. Edgecumbe Federal Complex was estimated to be $520,600 for sewage collection and treatment. The City of Sitka's cost for sewage treatment under this plan was estimated to be $347,500. No cost estimates for intercepting the Sitka outfalls were included.

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6. If negotiations with the City of Sitka are unsuccessful, or if considerable construction delays would be required, it is recommended Plan A for collection and treatment of sewage from Mt. Edgecumbe be adopted. The estimated cost of facilities proposed under this plan, which includes a separate treatment plant is $493,300.

7. The construction schedule recommended is as follows: start final design by May 1965; complete final design by October 1965; award contracts early in 1966; and complete construction by December 1966.

We wish to express our sincere appreciation to Mr. Theodore Ferris, Project Officer, and the other individuals who contributed information and assistance throughout our work on this study.

Respectfully submitted,

CORNELL, HOWLAND, HAYES & MERRYFIELD

Ralph E. Roderick
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Project Engineer

ELS/d

MT. EDGECUMBE

ALASKA

AN ENGINEERING STUDY OF SEWAGE DISPOSAL NEEDS FOR FEDERAL INSTALLATIONS

For

Department of Health, Education, and Welfare
Public Health Service
Bureau of State Services - EH
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Prepared By
Philleo Engineering and Architectural Service
and
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Corvallis, Oregon

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Appendix C	Detailed Cost Estimates

CHAPTER I

INTRODUCTION

AUTHORIZATION AND SCOPE

The study which this report summarizes was authorized by Contract No. 86-64-129 with the U. S. Public Health Service. Notice to proceed was made by letter dated 18 June 1964 by Ernest E. Tschopp, Contracting Officer, Department of Health, Education, and Welfare, Public Health Service, Contract Branch, to the firms of Cornell, Howland, Hayes & Merryfield and Philleo Engineering and Architectural Service, a joint venture.

The engineering study was authorized for the purpose of determining the most suitable method for collection and treatment of sewage discharged from the Mt. Edgecumbe, Alaska, Federal Complex.

The study was to include the following:

1. A determination of the volume and character of the liquid wastes originating on both the island and in the City of Sitka.

2. A determination of hospital practices that may affect the quality and character of the sewage.

3. A determination of the availability and types of shellfish in Sitka Sound, the harvesting practices and what effect the proposed discharge of treated effluent will have.

4. A discussion of the recreational, industrial, and other water uses in and around Mt. Edgecumbe and Sitka and their relation to the degree of treatment proposed.

5. An analysis of oceanographic data pertaining to Sitka Sound and adjacent waters, particularly as it relates to location of the sewer outfalls.

6. Consideration of any proposed increase in activities on the island, namely: increase in the size of the boarding school, construction of the proposed airport, and enlargement of the existing hospital.

7. A discussion and determination of the economic and engineering factors involving the feasibility of collecting all the waste from the existing multiple outfalls for treatment at one or more locations and the reason therefor.

8. Inclusion of the design criteria employed and preliminary cost estimates for the various proposals for waste treatment facilities for the Federal Complex at Mt. Edgecumbe separately or combined with a Sitka treatment facility.

9. A time schedule for the accomplishment of various phases of work proposed, including time allotted for design, bidding, contract letting, and construction.

10. Preparation of a bound report detailing the method of approach, findings, estimated costs, conclusions, and recommendations.

SOURCES OF INFORMATION

Information obtained from the following sources has been used herein in order to thoroughly cover the scope of this investigation.

1. Administrative staff members of the U. S. Public Health Service Hospital at Mt. Edgecumbe.

2. Bureau of Indian Affairs officials at the Native School at Mt. Edgecumbe.

3. The U. S. Public Health Service, Alaska Native Health Area Office in Anchorage, Alaska.

4. The office of the U. S. Public Health Service, Water Supply and Pollution Control in Portland, Oregon.

5. Construction and maintenance personnel at Mt. Edgecumbe.

6. City officials of the City of Sitka, Alaska.

7. The State of Alaska, Department of Health and Welfare, Division of Public Health.

8. The Federal Aviation Agency at Mt. Edgecumbe.

9. The Alaska Department of Fish and Game.

10. The State of Alaska, Department of Public Works, Division of Aviation.

11. Previous reports prepared for the City of Sitka by Carey and Kramer, Consulting Engineers, and by Hubbell and Waller Engineering Corporation.

12. The Alaska State Housing Authority.

13. Professor Robert D. Sylvester of the University of Washington on oceanographic work.

ON-SITE WORK

On-site work was conducted in July and September 1964 and included the following activities:

1. A field inspection of existing sewers and outfalls serving the Mt. Edgecumbe facilities and the City of Sitka.

2. A field survey to establish flow line elevations of existing sewers serving the Mt. Edgecumbe facilities.

3. Field surveys to establish ground profiles of proposed gravity sewer and pressure lines being considered.

4. Installation of flow measuring weirs in two manholes to measure the sewage flows from the areas served by the two major outfalls.

5. Collection of composite sewage samples from the two major outfalls and laboratory testing to determine the characteristics of these wastes.

6. Interviews and discussions were held with hospital medical and administrative personnel, Mt. Edgecumbe construction and maintenance personnel, B.I.A. school officials, local F.A.A. officials, Alaska Division of Aviation personnel, Alaska Southeast Regional Department of Health Sanitary Engineer, and City of Sitka officials to gather information pertinent to the study.

REPORT ORGANIZATION

Figures and tables in the report are numbered consecutively. Tables generally appear in the text of the report or, in some cases, on the page or pages following the first reference to the table. Figures are on the page or pages following first reference to the figure. A complete list of tables and figures appears in the table of contents.

BASIS OF COST ESTIMATES

Cost estimates included herein are based on estimated 1966 construction and material costs for the Sitka area. The estimates assume that all work will be performed by private contracting firms and include allowances for design engineering, inspection during construction, administration, and contingencies. Construction costs, as reported by the U. S. Public Health Service, have been increasing at a rate of approximately 3 percent per year, and there is every reason to believe this trend will continue. Therefore, an increase of approximately 3 percent should be added to the construction cost estimates contained herein for every year that construction is delayed beyond 1966.

ACKNOWLEDGMENTS

The writers acknowledge the courtesy and assistance received from Dr. George M. Wagnon, Medical Officer-in-Charge and Assistant Alaska Native Health Area Director, and Spencer A. Phillips, Executive Officer. We also acknowledge the assistance given by Mr. Dan Cole, Construction and Maintenance Superintendent; Mr. John Dolenc, Construction and Maintenance Plumbing and Steamfitter Foreman, and Mr. Rocky Gutierrez, Sitka City Engineer.

In addition to the above persons in the immediate Mt. Edgecumbe area, we also wish to acknowledge Mr. Theodore C. Ferris, Senior Sanitary Engineer with the Public Health Service Division of Water Supply and Pollution Control, Portland, Oregon, who was Project Officer under this contract. The assistance and cooperation received from Mr. Ferris in gathering data for the preparation of this report was sincerely appreciated.

CHAPTER II

EXISTING SEWERAGE FACILITIES

ENVIRONMENT AND TOPOGRAPHY

Mt. Edgecumbe and Sitka, Alaska, are located in a maritime type climate on the coastal islands of southeast Alaska. This climate is one of frequent precipitation averaging approximately 85 inches per year with the major portion occurring as rain. Snow accumulations are moderate and would not be expected to be a factor in a sewage treatment plant design. The prevailing winds are south and southeast with temperature variance between 0 and 70 degrees with a mean of 45 degrees.

The Mt. Edgecumbe Federal Complex is located on Japonski, Charcoal, and Alice Islands which are three small islands interconnected by a road system. These islands consist mostly of rock with a shallow overburden of topsoil in some places and are generally hilly except where the rock has been blasted level for construction of buildings. Figures 1 and 1-A are photographs of the Mt. Edgecumbe Federal Complex and the City of Sitka. The City of Sitka located across Sitka Sound from Mt. Edgecumbe on Baranof Island has a relatively level townsite encircled to landward by sharply rising 5,000-foot peaks.

MT. EDGECUMBE SEWERAGE SYSTEM

General Description. The Mt. Edgecumbe Federal Complex is located on Japonski, Alice, and Charcoal Islands having a combined total area of approximately 290 acres. The Complex consists of a 168-bed hospital operated by the U. S. Public Health Service, a 700-student boarding school operated by the Bureau of Indian Affairs, a Federal Aviation Agency installation, and administrative offices, shops, boarding facilities, and staff quarters for government personnel. At the time of the writing of this report, a contract had been awarded for the initial phase of construction for an airport to serve the City of Sitka. The airport is to be located on about 75 acres on the westerly side of Japonski Island. It is estimated that the total population on the island is 1,800 persons.

Of the total area of 290 acres about 135 acres are presently served by sewers. The existing sanitary sewer system is constructed of 4-inch to 15-inch cast iron, clay, concrete, wood stave, and steel

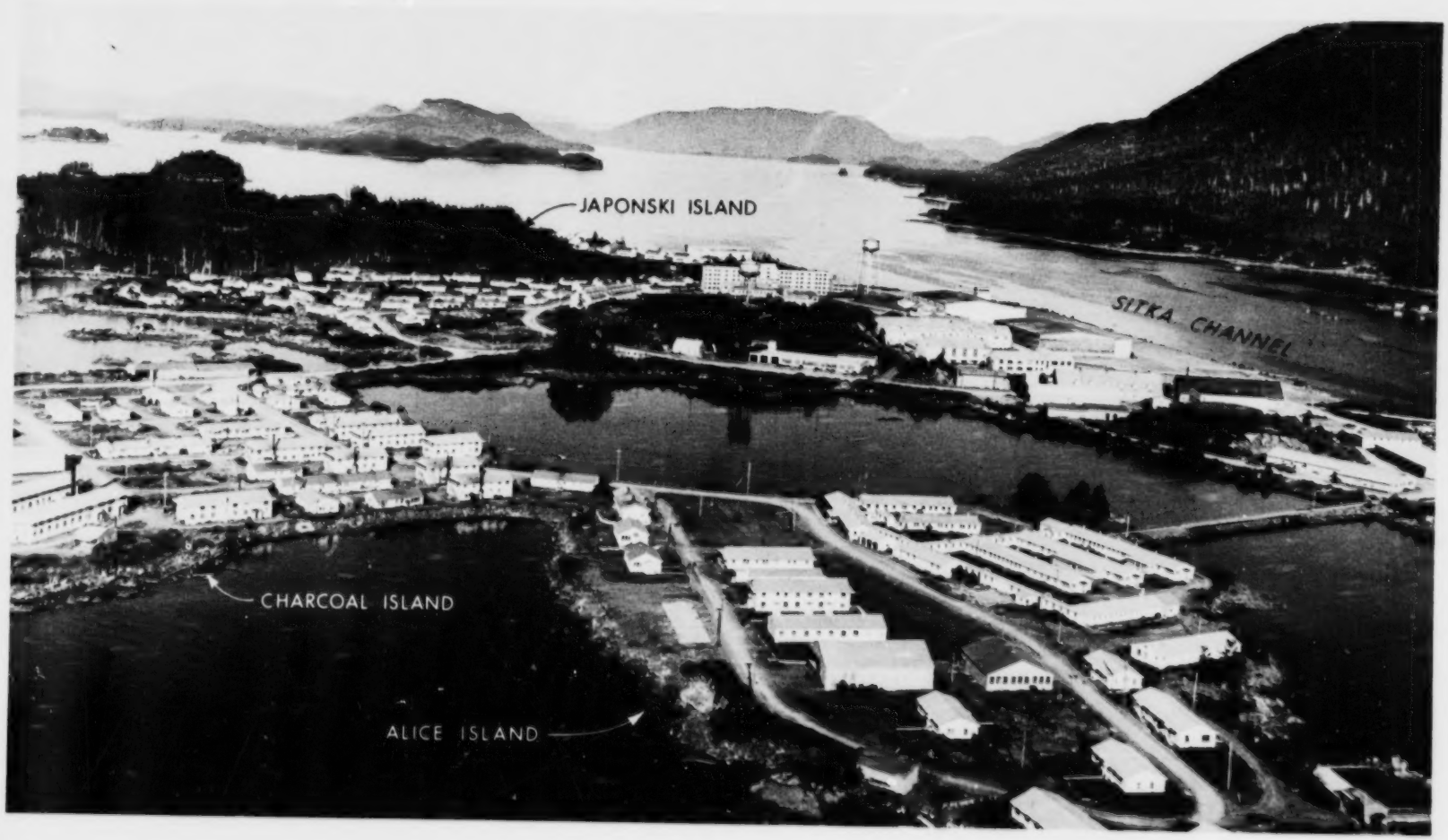

FIGURE 1

MT. EDGECUMBE, ALASKA
SEWERAGE STUDY

MT. EDGECUMBE

Photograph By
The Photo Shop Studio
Sitka, Alaska

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FIGURE 1A

MT. EDGECUMBE, ALASKA
SEWERAGE STUDY
SITKA, MT. EDGECUMBE

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pipe. The total length of sewer on the island is about 15,000 feet. The wastes from these sewers are discharged through 18 outfalls as shown on Figure 1-B. Present estimated average daily flows being discharged into the waters of Sitka Sound from the outfalls total 264,400 gallons per day. Following is a detailed discussion of these outfalls.

Outfall 1. This outfall serves 6 single family residences and 5 duplex units with a total estimated population of 75. There is about 1,170 feet of 6-inch clay sewer serving this area of 3.1 acres. The outfall is an 8-inch cast iron line discharging into Sitka Sound. The outfall is buried below the ground surface and is nearly always submerged at low tide.

The present estimated average summer flow from this outfall is 9,600 gallons per day (gpd), with a peak or maximum flow rate of 29,000 gallons per day (gpd) or 20 gallons per minute (gpm).

Outfall 2. This outfall serves the Bachelor Officer's Quarters (BOQ). The BOQ has 56 rooms and a cafeteria that serves an average of 210 meals per day. This facility is sewered by approximately 160 feet of 6-inch cast iron pipe. Present summer flow from the BOQ and cafeteria is estimated to average 6,600 gpd. The maximum flow rate is estimated at 36,000 gpd (25 gpm). The outfall is submerged for its entire length at low tides.

Outfall 3. This outfall serves an area of 4.0 acres with 14 single family residences, 2 duplex units, and a single quarter building with an estimated total population of 72 persons. The sewers within the area consist of 1,400 feet of 6-inch wood stave pipe and 8-inch concrete pipe. The estimated average summer flow is 10,200 gpd and the estimated maximum flow rate is 29,000 gpd (20gpm). Outfall 3 is shown on Figures 2-A and 2-B. These pictures and all following pictures of outfalls were taken at plus 1.5 low tide. The outfall is corrugated metal pipe encased in concrete and is submerged only at high tides. For this reason, an unsightly and insanitary condition exists much of the time from sewage solids accumulating on the beach at the end of the outfall.

Outfall 4. Outfall 4 serves the boys' gym and the Federal Aviation Agency offices and facilities. There is 220 feet of 10-inch clay pipe sewer leading from the facilities to a 10-inch cast iron outfall. The estimated present average summer flow from the outfall is 1,900 gpd and the maximum flow rate is estimated to be 21,500 gpd (15 gpm).

LEGEND

BUILDINGS TO BE REMOVED DURING AIRPORT CONSTRUCTION

MAINTENANCE AND WAREHOUSE BUILDINGS

BUREAU OF INDIAN AFFAIRS BUILDINGS

LIVING QUARTERS

WATER OR OIL STORAGE TOWERS AND TANKS

① EXISTING SEWER OUTFALLS

AREAS SERVED BY EXISTING OUTFALLS

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FIGURE 1B
MT. EDGECUMBE, ALASKA
SEWERAGE STUDY
EXISTING SEWER OUTFALLS

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FIGURE 2A OUTFALL NO.3

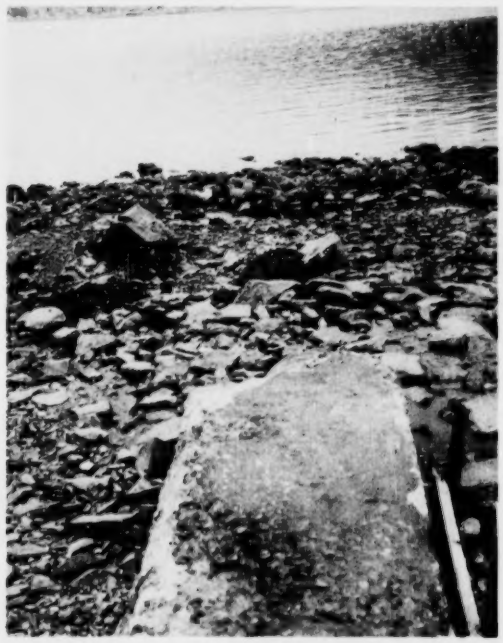

FIGURE 2B OUTFALL NO.3

FIGURE 2C OUTFALL NO.4

MT. EDGECUMBE, ALASKA
SEWERAGE STUDY

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Only at high tides does the outfall become submerged. As seen on Figure 2-C, this presents a very insanitary and unsightly condition.

Outfall 5. This outfall, shown on Figures 3-A and 3-B, serves the vocational shop. An 8-inch clay pipe sewer 220 feet in length leads from the vocational shop to an 8-inch cast iron pipe outfall. The estimated present average summer flow is 2,000 gpd and the maximum estimated flow rate is 21,500 gpd (15 gpm). The outfall is encased in concrete, as shown on Figure 3-B, and extends some 25 feet from the edge of the bank. It is not submerged at low tides. Figure 3-A shows a broken joint in the clay pipe about 15 feet from the end of the outfall. This joint is submerged only at very high tides.

Outfall 6. Outfall 6 serves an area of 6.7 acres and collects wastes from the U. S. Public Health Service Hospital, the school cafeteria, the girls' dormitories and gym, the high school, and the power plant. The power plant cooling water is discharged separately from the sanitary wastes as discussed later in this chapter.

The sewers within this area consist of 1,930 feet of 8-, 10-, 12-, and 15-inch clay and 6-inch wood stave pipe. The outfall is always submerged at low tide.

Flow measurements taken over a 12-hour period on 22 October 1964 indicated an average 12-hour flow of 138,000 gpd and a peak flow rate of 150 gpm. The 24-hour average flow rate for this day was estimated to be 88,000 gpd.

The average summertime flow is estimated to be approximately 82,000 gpd.

Outfall 7. Outfall 7 serves an abandoned administration building and a warehouse. The only wastes carried from these buildings are wastes from rest rooms and the flow is negligible. There is 170 feet of 6-inch wood pipe leading from the buildings to the outfall which is submerged even at low tide.

Outfall 8. Outfall 8, shown on Figure 3-C, is a 4-inch steel pipe serving a boat repair shop. It is about 100 feet long and is not submerged at low tides. Flow from this outfall is negligible.

Outfall 9. Outfall 9, shown on Figure 5-A, serves the electric and plumbing shop and is a 4-inch steel pipe 80 feet in length. It carries wastes only from a few rest rooms and the flow is negligible. At no time is the end of the outfall submerged.

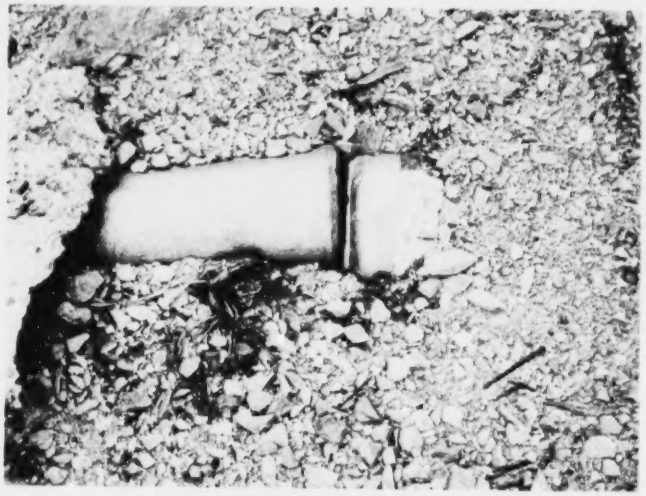

FIGURE 3A OUTFALL NO.5

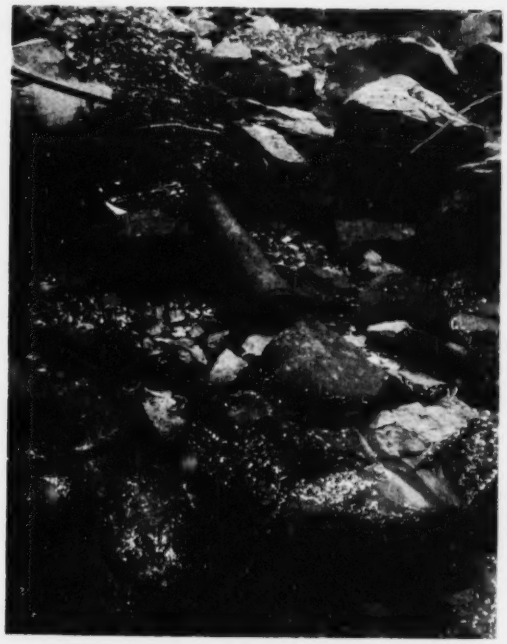

FIGURE 3B OUTFALL NO.5

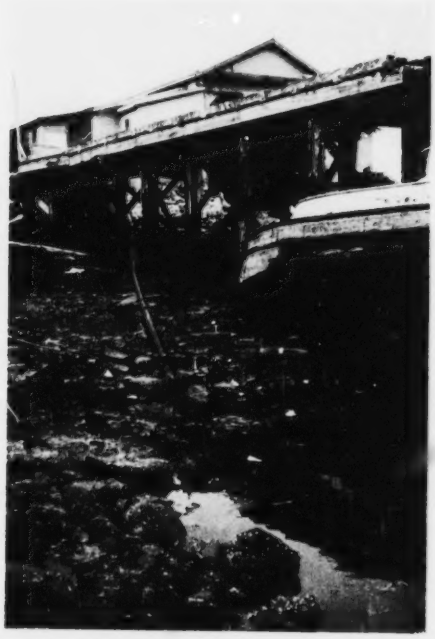

FIGURE 3C OUTFALL NO. 8

MT. EDGECUMBE, ALASKA
SEWERAGE STUDY

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Outfall 10. Outfall 10, shown on Figures 4-A and 4-B, serves the laundry and is constructed of 10-inch clay pipe. The end of the outfall is not submerged at low tides.

The present average summer flow from this outfall is estimated to be 11,000 gpd. The maximum estimated flow rate is 79,000 gpd (55 gpm).

Outfall 11. The fire station and carpenter shop is served by Outfall 11. The outfall is constructed of 4-inch steel pipe and the end of the outfall is never submerged. Flow from the outfall is negligible.

Outfall 12. Outfall 12 serves 26 multiple family residences and 5 single family units with an estimated total population of 102 people. A 6 classroom grade school is also proposed. The 2,270 feet of sewers within this 7.3 acre area are constructed of 4-, 6-, and 8-inch wood stave pipe. The outfall itself is a 10-inch cast iron pipe which is always submerged. The estimated average summer flow from this area is 17,000 gpd. The maximum flow rate is estimated to be 57,500 gpd (40 gpm).

Outfall 12a. Outfall 12a serves a single family residence and is a 6-inch steel pipe completely submerged. This residence was unoccupied at the time field work for this study was being done.

Outfall 13. Outfall 13, shown on Figure 5-B, serves an area of 11.1 acres and collects wastes from 7 single family residences, 57 multiple family units, and 43 single quarters units. The estimated population of the area is 233 persons. Sewers within the area are 4-, 8-, 10-, and 12-inch wood stave pipe totaling 2,830 feet in length. A portion of the 10-inch wood stave pipe was reportedly replaced by 10-inch bituminous fibre pipe in 1961 and 1962. The outfall itself is constructed of 12-inch cast iron pipe and is not submerged at low tides. The average summer flow from this area is estimated at 31,600 gpd and the maximum flow rate is estimated at 101,000 gpd (70 gpm).

Outfall 14. Outfall 14 is constructed of 8-inch cast iron pipe and only serves 2 rest rooms in warehouses. Sewers within the area are 380 feet in length. The outfall is completely submerged and the flow is negligible.

FIGURE 4A OUTFALL NO.10

FIGURE 4B OUTFALL NO.10

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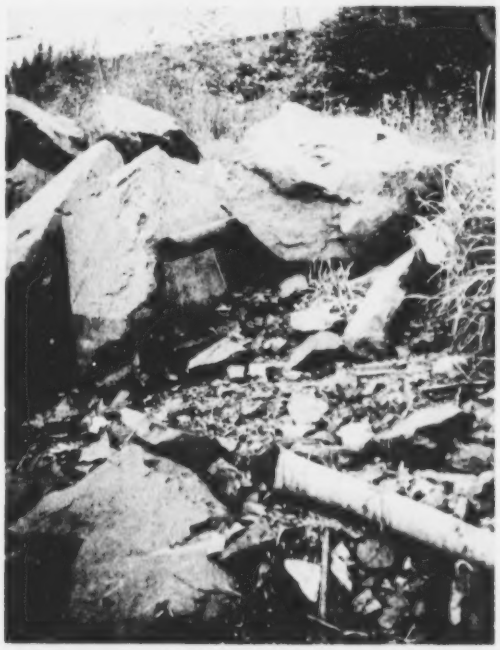

FIGURE 5A OUTFALL NO. 9

FIGURE 5B OUTFALL NO. 13

FIGURE 5C POWER PLANT COOLING WATER OUTFALL

MT. EDGECUMBE, ALASKA

SEWERAGE STUDY

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Outfall 15. Outfall 15, shown on Figure 6-A, serves an area of 11.3 acres and collects wastes from the administration part of the hospital, the boys' dormitory, and 86 multiple family units. The sewers within the area consist of 2,850 linear feet of 4-, 6-, 8-, and 10-inch wood stave pipe and 4- and 6-inch cast iron pipe. The outfall itself is encased in concrete and the discharge end is always submerged.

Flow measurements taken over a 12-hour period on 22 October 1964 indicated an average 12-hour flow of 64,500 gpd and a maximum flow rate of 85 gpm.

From design criteria developed in Chapter III, it is estimated that the probable average summer flows more nearly approximate 82,300 gpd, with a probable maximum flow rate of 185 gpm.

Outfall 16. Outfall 16, shown on Figure 6-B, serves an area of 2.2 acres having 14 multiple family units with an estimated population of 96 persons. The 460 linear feet of 4- and 6-inch wood stave pipe within the area leads to the 8-inch cast iron pipe outfall. The discharge end of the outfall is not submerged at low tides. The average summer flow is estimated at 10,200 gpd and the maximum flow rate at 36,000 gpd (25 gpm).

Outfall 17. Outfall 17 is 460 feet in length and serves one rest room in the Federal Aviation Agency facility on the north end of the island. The flow from this outfall is negligible.

Power Plant Cooling Water. Cooling water from the power plant is discharged into Sitka Channel through a 20-inch steel outfall. This outfall, shown on Figure 5-C, is located between sewer Outfalls 6 and 7 and is completely separated from sanitary sewage flows. At the present time, the power plant is on standby emergency service status and is not continuously in operation.

Proposed Division of Aviation Work. Construction of the Sitka Airport on the west side of Japonski Island will isolate Outfalls 14, 15, and 16 and prevent the discharge of sewage into the bay. The construction contract recently awarded for the initial phase of construction on the airport includes provisions for extending Outfalls 15 and 16 to a point beyond the landing strip. Figure 7 shows how the Division of Aviation plans to combine the two outfalls into a common outfall extending beyond the landing strip fill.

There are no proposed plans to extend Outfall 14 beyond the landing strip. The isolation of Outfall 14 does not appear to present an immediate problem since the flow from the outfall is negligible.

FIGURE 6A OUTFALL NO. 15

FIGURE 6B OUTFALL NO. 16

MT. EDGECUMBE, ALASKA
SEWERAGE STUDY

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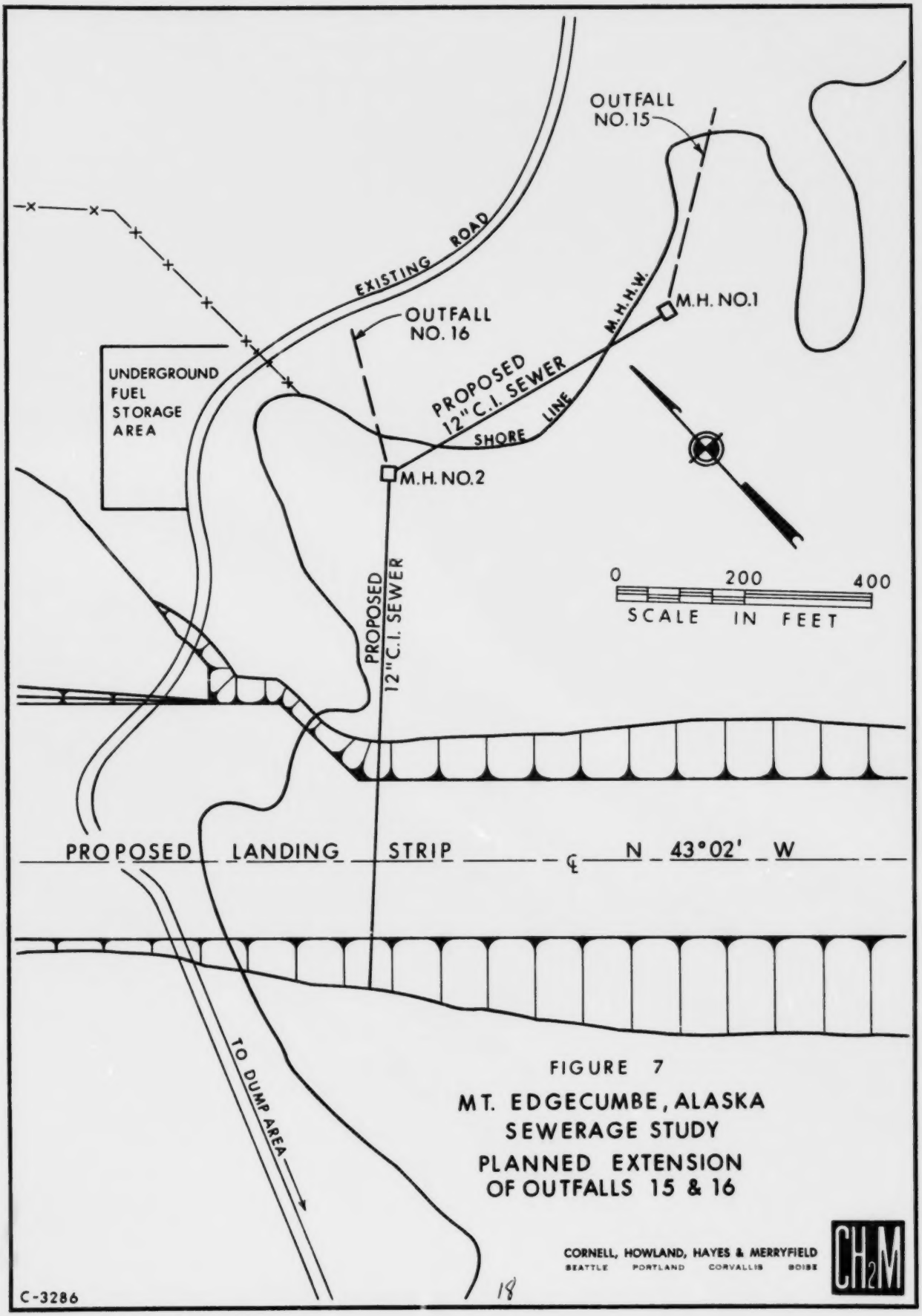

FIGURE 7

MT. EDGECUMBE, ALASKA
SEWERAGE STUDY
PLANNED EXTENSION
OF OUTFALLS 15 & 16

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A memorandum dated 25 June 1964, written by Mr. Kenneth C. Lauster, U. S. Public Health Service Sanitary Engineer, reporting on a conference he held with Alaska Division of Aviation representatives relative to the proposed Sitka Airport made note of Outfalls 9, 10, and 11 being affected by the proposed airport road construction. The memorandum indicated that Division of Aviation would include in their plans and specifications for construction, provisions for combining Outfalls 9, 10, and 11 into a single outfall which would be extended to below low water in the bay to the south of Charcoal and Alice Islands.

SITKA SEWERAGE SYSTEM

General Description. The City of Sitka sewerage system is similar to Mt. Edgecumbe's in that the sewage is discharged into Sitka Channel through 12 outfalls as shown on Figure 8. The sewer collection system consists of approximately 30,000 linear feet of sewer varying in size from 4-inch to 15-inch with the majority of it being 6-inch. A detailed description of the City of Sitka sewer collection system is not within the scope of this report. Detailed studies have been authorized by the City and these were made by Hubbell & Waller Engineering Corporation, Seattle, Washington, and by Carey and Kramer, Consulting Engineers, Seattle, Washington. It was reported that at the present time the City of Sitka is using the Hubbell & Waller report as a guide in making improvements to the municipal sewer collection system. A recent improvement made included abandoning two city sewer outfalls in the vicinity of City Outfall 4 (Figure 8) and making the necessary changes whereby sewage from the abandoned outfalls is now discharged through City Outfall 4. Another project recently completed was the construction of City Outfall 3 shown on Figure 8. City Outfall 3 was constructed to eliminate the need for two outfalls which had discharged into Crescent Bay and would have interfered with the development of a small boat harbor now under construction.

Based on a population of 3,500 persons in Sitka and an average per capita flow of 150 gallons per day, it is estimated that an average sewage flow of 525,000 gallons per day is discharged into Sitka Channel from the 12 outfalls serving the City of Sitka.

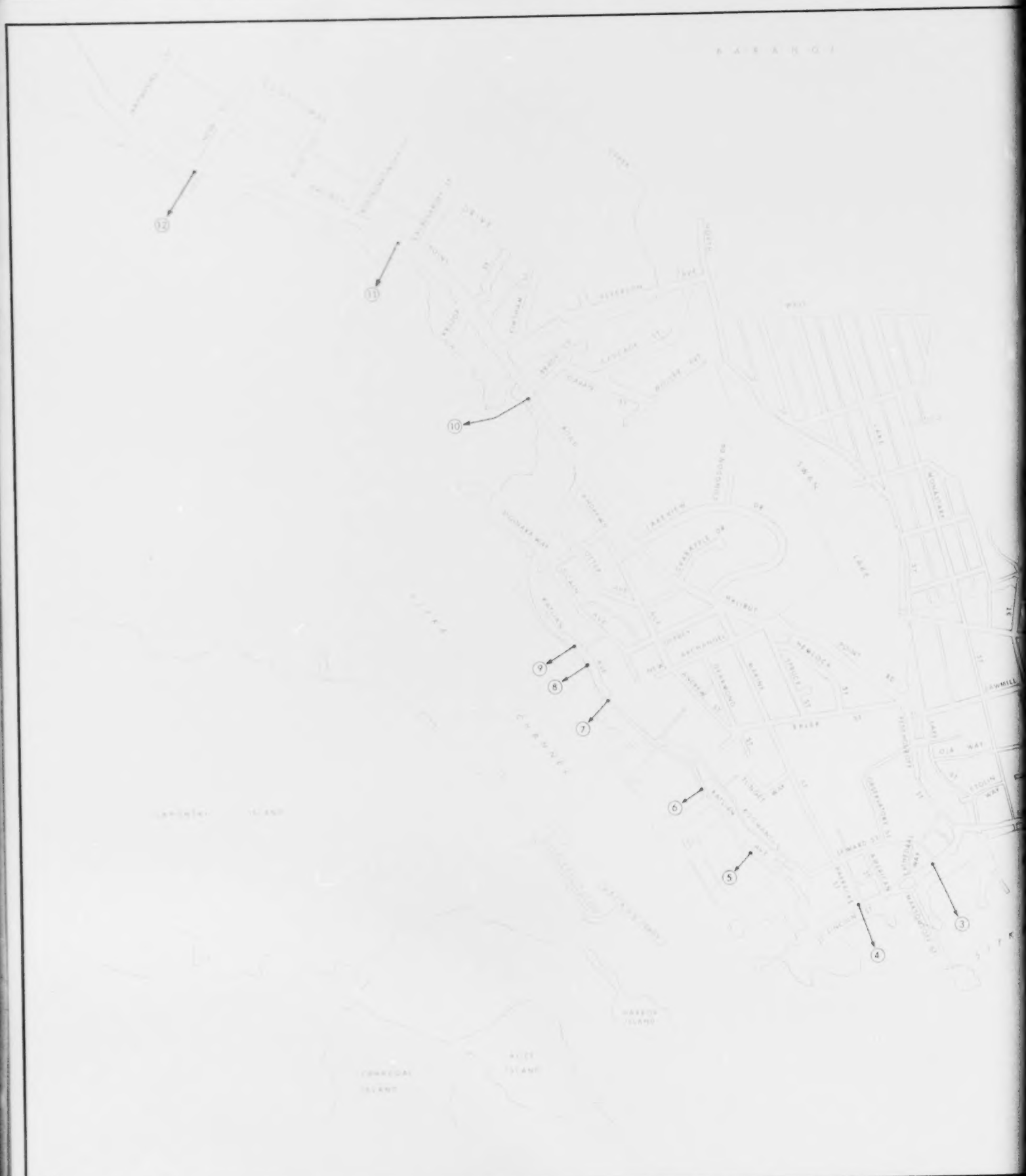

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FIGURE 8

MT EDGECUMBE, ALASKA
SEWERAGE STUDY

SITKA SEWER OUTFALLS

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CHAPTER III

PROPOSED COLLECTION SYSTEMS

DESIGN CRITERIA

General. Sanitary sewer systems are designed and existing systems are evaluated on the basis of their ability to serve their respective fully developed service areas. In order to properly size the various components of the system or to investigate existing components, a determination must be made of the areas to be served, anticipated population, per capita sewage flows, and reasonable allowances for infiltration of surface storm water and groundwater into the sewers.

The following design criteria developed for the proposed systems was also used for the flows indicated in Chapter II for the existing system.

Population. The flow contributing population of each outfall service area was determined by referring to the Quarters Directory for Mt. Edgecumbe, from which the number of bedrooms in each single or multiple family unit was taken. It was then estimated that there were 1.5 persons per bedroom. For single quarters buildings, dormitories, schools, and bachelor officers quarters; the number of actual occupants or students was used.

Per Capita Sewage Flows.

Residences. Experience indicates that the average per capita sewage flows can be expected to average approximately 100 gallons per day. Maximum peak flows from a small residential area sometimes reach 3.5 times the average; and, therefore, a maximum per capita flow rate of 350 gallons per day has been assumed.

School. It is estimated that the average sewage flow from the school, exclusive of gymnasium or cafeteria flows, is 10 gallons per student per day. This assumption conforms to generally accepted design criteria for flow rates from educational institutions.

Cafeteria. Sewage flows from the two cafeterias were estimated to be 10 gallons per day for each three meals served.

Dormitories. An average of 75 gallons sewage flow per day for each student housed in the dormitories was assumed. Where future dormitories are to be built, 100 gallons per capita per day of sewage flow was assumed due to the expected construction of self-sustaining type dorms with cafeteria, etc.

Other Sewage Sources.

Hospital. It is estimated that the average sewage flow from the hospital is 200 gallons per day per each bed in the present 168 bed hospital.

Laundry. Very good records have been kept by Mr. Hammett, Jr., laundry foreman. These records show that when the B. I. A. school is in session an average of 70,000 pounds of linen are laundered at the laundry each month. American Water Works Association, Manual M8, indicates an average of 3 gallons of water is required per pound of laundry processed at institutional laundries. Mr. Hammett indicated this figure was very close to what he would estimate the water requirements to be for the laundry at Mt. Edgecumbe.

Infiltration and Storm Water Entry. Experience has shown that well designed and constructed sewers can be safely designed with an allowance of 1,500 gallons per acre served per day for unavoidable storm and groundwater entry. Older systems with poor materials and workmanship may leak 5 to 6 times this amount; however, visual inspection of the existing sewers on Japonski, Alice, and Charcoal Islands did not show any evidences of excessive infiltration. Therefore, an infiltration allowance of 1,500 gallons per day per acre was used in calculating the maximum expected flow rates and one-half this amount was used in computing average summer flows.

Future Expansion. Estimated sewage flows from the various sewer service areas served by the individual outfalls were increased as required where a new facility would possibly be located in a service area. The only new facilities taken into consideration in the planning are those facilities proposed by the Bureau of Indian Affairs which would permit increasing the B. I. A. school enrollment to 1,200 students. The proposed B. I. A. facilities locations are indicated on Figures 1B, 10, and 11. Locations of the facilities which could be constructed were obtained from a Site Plan drawing of Mt. Edgecumbe which had been prepared by the Branch of Plant Design and Construction of the Bureau of Indian Affairs, Albuquerque, New Mexico, and dated 17 July 1963.

It was reported that no need for expanding the Mt. Edgecumbe hospital facility could be seen for any time within the foreseeable future. Therefore, no allowance was made for an increase in flow from the hospital.

SUMMARY

Table 1 summarizes the criteria used in estimating the present and future sewage flows for the existing system and the proposed sewerage system plans.

TABLE 1

SEWER DESIGN CRITERIA

Residences	
Average Flow	100 gpcd
Design Flow (Max)	350 gpcd
School - Average Flow	10 gpcd
Cafeteria - Average Flow	10 gpd/3 meals
Dormitories - Average Flow	
Existing Dorms	75 gpcd
Future Dorms	100 gpcd
Hospital - Average Flow	200 gpd/bed
Laundry - Average Flow	3 gal/lb
Infiltration Allowance	
For Maximum Flow Rate	1,500 gpad
For Average Design Flows	750 gpad

Maximum flow rates used for design of the sewers from all sources except single or multiple family residences, were assumed to be 3 times the average flows indicated in Table 1.

Table 2 summarizes the estimated present and design flows from different outfall areas with students in attendance at the boarding school. The maximum design flows shown would be used in design of sewers and the average design flows would be used in the design of sewage treatment facilities.

TABLE 2

MT. EDGECUMBE ESTIMATED SEWAGE FLOWS

Out-fall No.	Present Flows Average (gpd)	Present Flows Maximum (gpd)	Design Flows Average (gpd)	Design Flows Maximum (gpd)
1	9,600	29,000	9,600	29,000
2	6,600	36,000	6,600	36,000
3	10,200	29,000	30,200	91,000
4	1,900	21,500	7,500	43,000
5	2,000	21,500	7,500	43,000
6	82,000	216,000	82,000	216,000
7	*	*	*	*
8	*	*	*	*
9	*	*	*	*
10	11,000	79,000	14,000	100,000
11	*	*	30,000	90,000
12	17,000	57,500	17,000	57,500
12a	*	*	*	*
13	31,600	101,000	31,600	101,000
14	*	*	*	*
15	82,300	265,000	82,300	265,000
16	10,200	36,000	10,200	36,000
17	**	**	**	**
Total	264,400	891,500	328,500	1,107,500

* Negligible Flow
** Outfall 17 Not Used

PROPOSED ALTERNATE PLANS

General. Three alternate plans have been considered as possible solutions for collecting and treating the sewage at Mt. Edgecumbe. These plans will be discussed hereinafter in detail and are as listed as follows:

Plan A. Interception of all flows and treatment at a sewage treatment plant at the northwesterly end of Japonski Island.

Plan B. Interception of all flows and treatment at a sewage treatment plant located west of the proposed air strip on Japonski Island.

Plan C. Interception of all flows and pumping of the combined wastes across Sitka Channel for treatment in a treatment plant serving both Mt. Edgecumbe and the City of Sitka.

Because of the large quantities of rock encountered in trench excavation on Mt. Edgecumbe, every effort has been made to keep the sewers as shallow as possible to eliminate as much rock excavation as possible. Profiles showing the gravity sewers under the various plans are shown in Appendix A. All pressure lines would be at a depth of about 4 feet or less and no profiles are shown for these lines.

Pump stations are an important part of the collection systems proposed under the various plans. Two types of pump stations have been selected for preliminary estimating at Mt. Edgecumbe. Figure 9A shows a typical submersible pump station installation. This type of pump station is proposed where there are comparatively small flows to be pumped in the range of 0 - 50 gpm. Three of these pump stations would be used under each plan. Figure 9B shows a typical all steel, factory-built pump station installation, which is proposed where flows are 100 gpm and greater. Four of these steel fabricated pump stations would be used under each plan.

In all cases, interception of each outfall would be made so that automatic emergency bypassing of each station through the existing outfall would occur during pump or power failure. Bypassing could also be accomplished to enable pump station or wet well repair or maintenance. A spare pump would be provided for emergency use at the submersible pump stations to minimize bypassing in the event of a pump failure.

Cost estimates for the various plans are compared in Chapter V.

Plan A. Figure 10 has been prepared showing the proposed sewerage system under Plan A. Under Plan A, the flow from all existing outfalls, except Outfall 17, would be intercepted at the sewage pump stations and pumped into new or existing gravity sewer mains. These

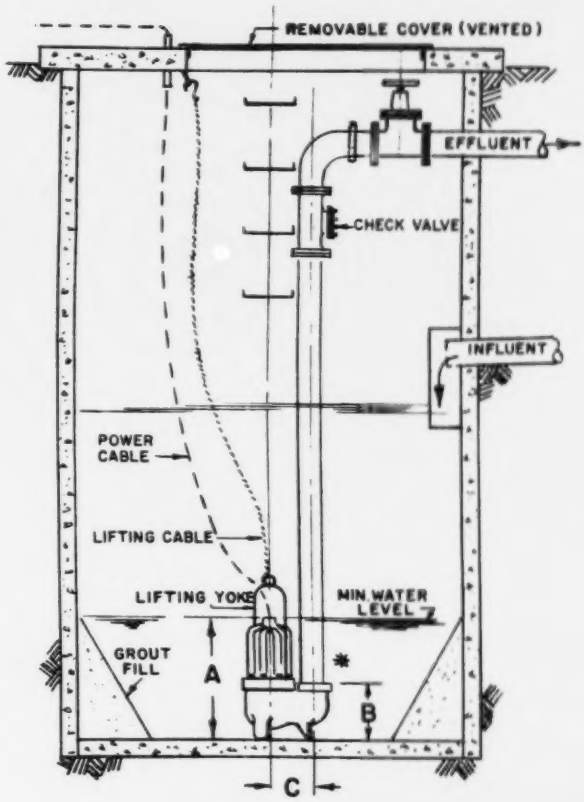

FIGURE 9A TYPICAL SUBMERSIBLE PUMP STATION INSTALLATION

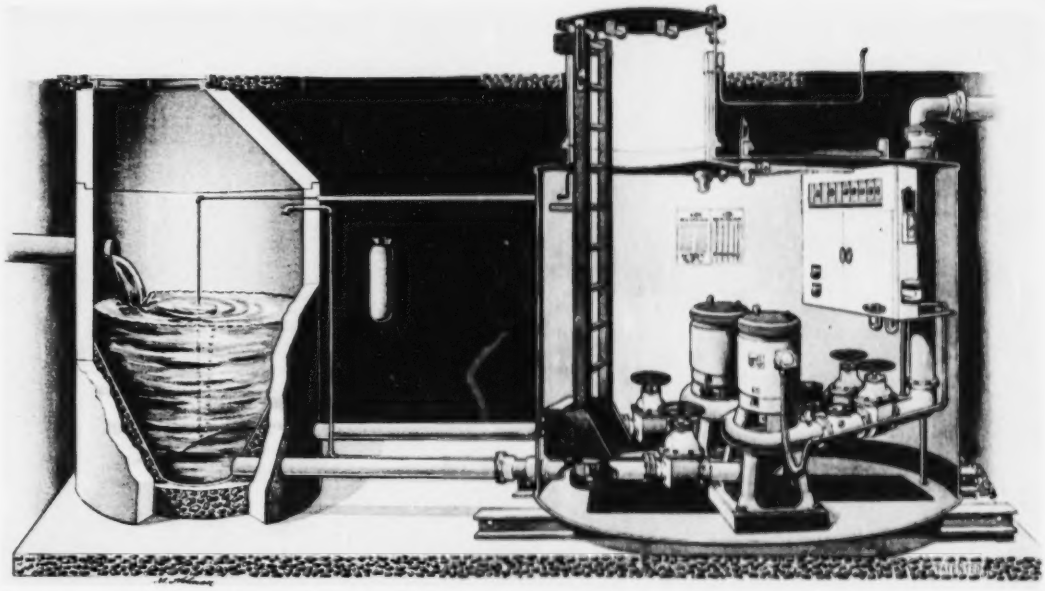

FIGURE 9B TYPICAL FACTORY BUILT PUMP STATION INSTALLATION

MT. EDGECUMBE, ALASKA
SEWERAGE STUDY

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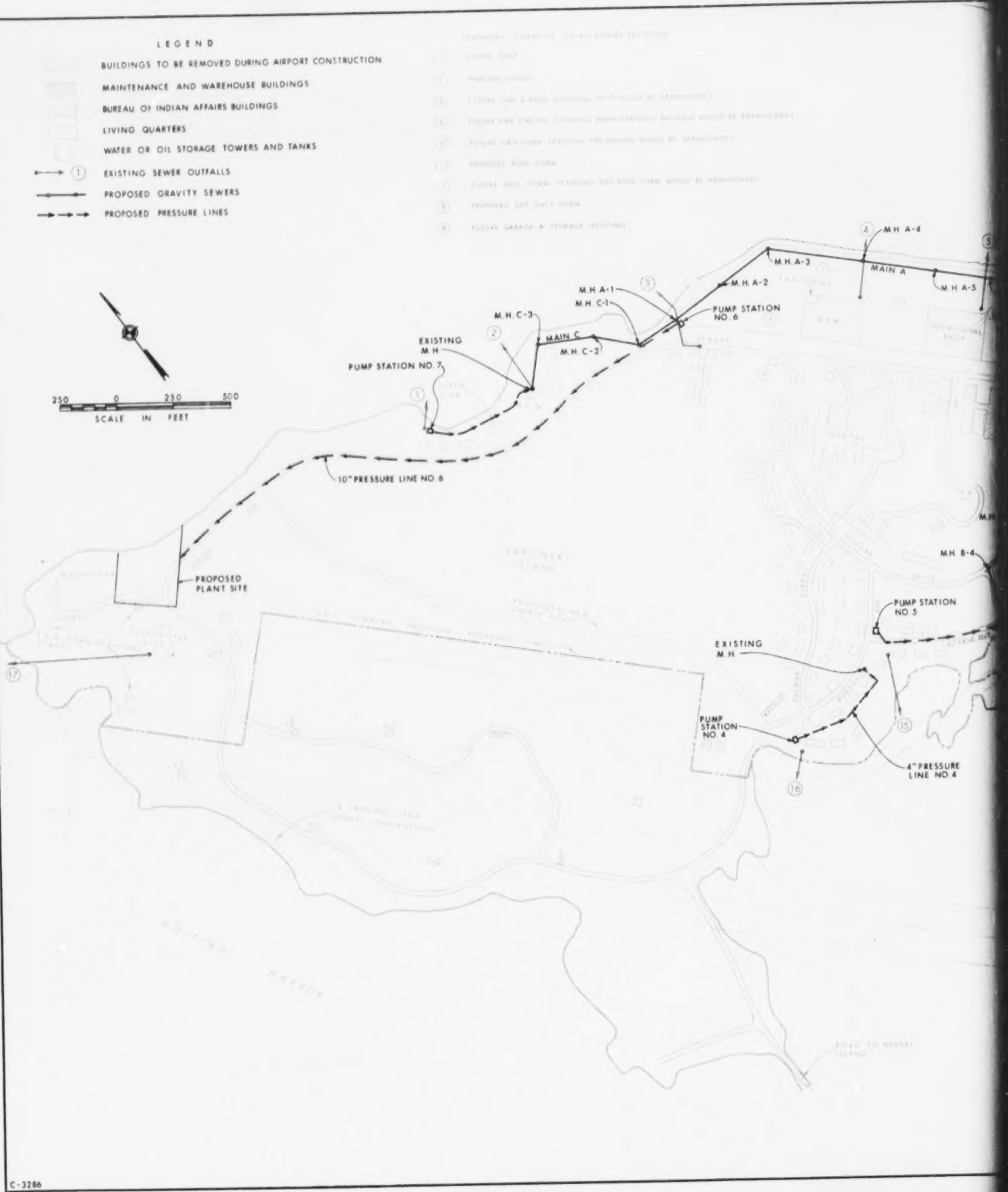
LEGEND
BUILDINGS TO BE REMOVED DURING AIRPORT CONSTRUCTION
MAINTENANCE AND WAREHOUSE BUILDINGS
BUREAU OF INDIAN AFFAIRS BUILDINGS
LIVING QUARTERS
WATER OR OIL STORAGE TOWERS AND TANKS
1 EXISTING SEWER OUTFALLS
PROPOSED GRAVITY SEWERS
PROPOSED PRESSURE LINES
250 0 250 500
SCALE IN FEET
M.H. A-4
M.H. A-3
MAIN A
M.H. A-5
M.H. A-2
M.H. A-1
M.H. C-1
PUMP STATION NO. 6
M.H. C-3
MAIN C
M.H. C-2
EXISTING M.H.
PUMP STATION NO. 7
10" PRESSURE LINE NO. 6
PROPOSED PLANT SITE
M.H. B-4
PUMP STATION NO. 5
EXISTING M.H.
PUMP STATION NO. 4
4" PRESSURE LINE NO. 4

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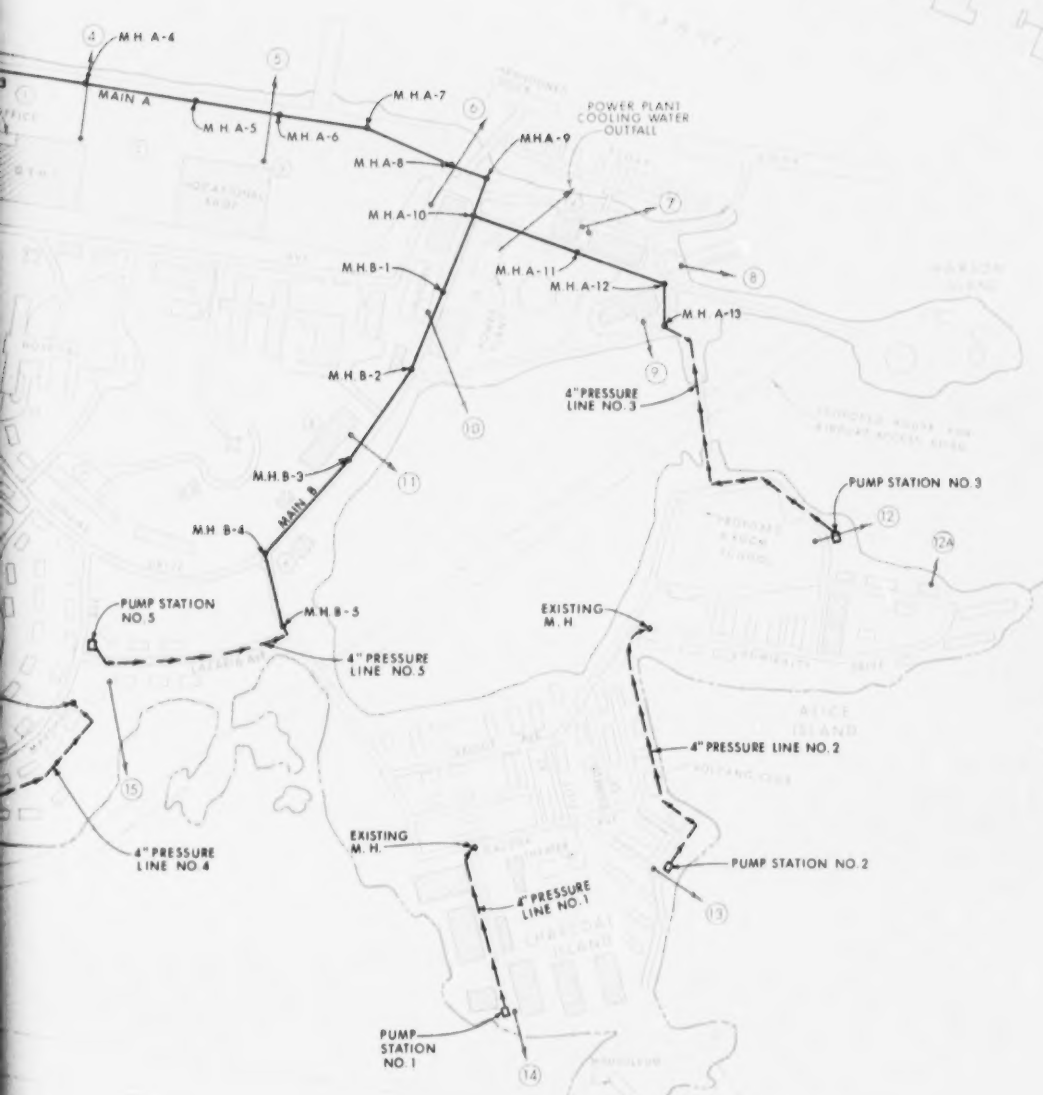

FIGURE 10

MT. EDGECUMBE, ALASKA
SEWERAGE STUDY

PROPOSED SEWERAGE SYSTEM
PLAN A

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mains eventually convey the sanitary wastes from the Federal Complex to a sewage treatment plant site located on the northwesterly end of Japonski Island.

Pump Station No. 1 would be a submersible type installation which would intercept flow from Outfall 14. The pump station would have a minimum capacity of 50 gpm and would pump all flow through a 4-inch pressure line to an existing manhole on Galena Avenue. The sewage would then flow by gravity in an existing sewer to Outfall 13 where it would be intercepted by Pump Station No. 2.

Pump Station No. 2 would be a factory-built type installation that would intercept all flow from Outfall 13. The pump station would have a capacity of 100 gpm and would pump the flow through a 4-inch pressure line to an existing manhole on Admiralty Drive. The sewage would then flow by gravity in an existing sewer to Outfall 12 where it would be intercepted by Pump Station No. 3.

Pump Station No. 3 would be a factory-built type installation with a capacity of 150 gpm and would pump the sewage through a 4-inch pressure line to Manhole A-13 at the upper end of the new gravity sewer designated Main A.

Under all plans, it is suggested that Outfall 12a be abandoned. The sewer service line from this house can be connected to the existing sewer in the street in front of the house.

Main A would be an 8-inch line between Manholes A-13 and A-10. Between Manholes A-13 and A-10, Main A would intercept Outfalls 9, 8, and 7; and at Manhole A-10 it would intercept Main B.

Pump Station No. 4 would be a submersible type installation which would intercept Outfall 16. It would have a capacity of 50 gpm and would pump the sewage through a 4-inch pressure line to an existing manhole on Marshall Avenue. The sewage would then flow by gravity in the existing sewer to Outfall 15, where it would be intercepted by Pump Station No. 5.

Pump Station No. 5 would be a factory-built installation which would intercept all flow from Outfall 15. It would have a capacity of 200 gpm and would pump the sewage through a 4-inch pressure line to the end manhole on the gravity sewer designated Main B.

Main B would be an 8-inch line for its entire length and would intercept Outfalls 10 and 11. It was anticipated that the Bureau of

Indian Affairs would construct new dormitories in this vicinity. Therefore, Main B has been sized to handle all flows anticipated from these dormitories.

Main A becomes a 10-inch line after intercepting Main B at Manhole A-10 and remains as such until it intercepts Outfall 6 at Manhole A-8. Between Manhole A-8 and A-1, Main A would be a 12-inch line and intercepts Outfalls 5, 4, and 3. There is more school expansion anticipated in this area, and Main A has been sized to carry all future flows should the facilities be constructed.

Pump Station No. 7 would be a submersible type installation that would intercept all flow from Outfall 1. It would have a capacity of 50 gpm and would pump the sewage through a 4-inch pressure line to an existing manhole behind the BOQ. A new 8-inch gravity sewer designated Main C would carry the sewage from Outfalls 1 and 2 to Manhole A-1.

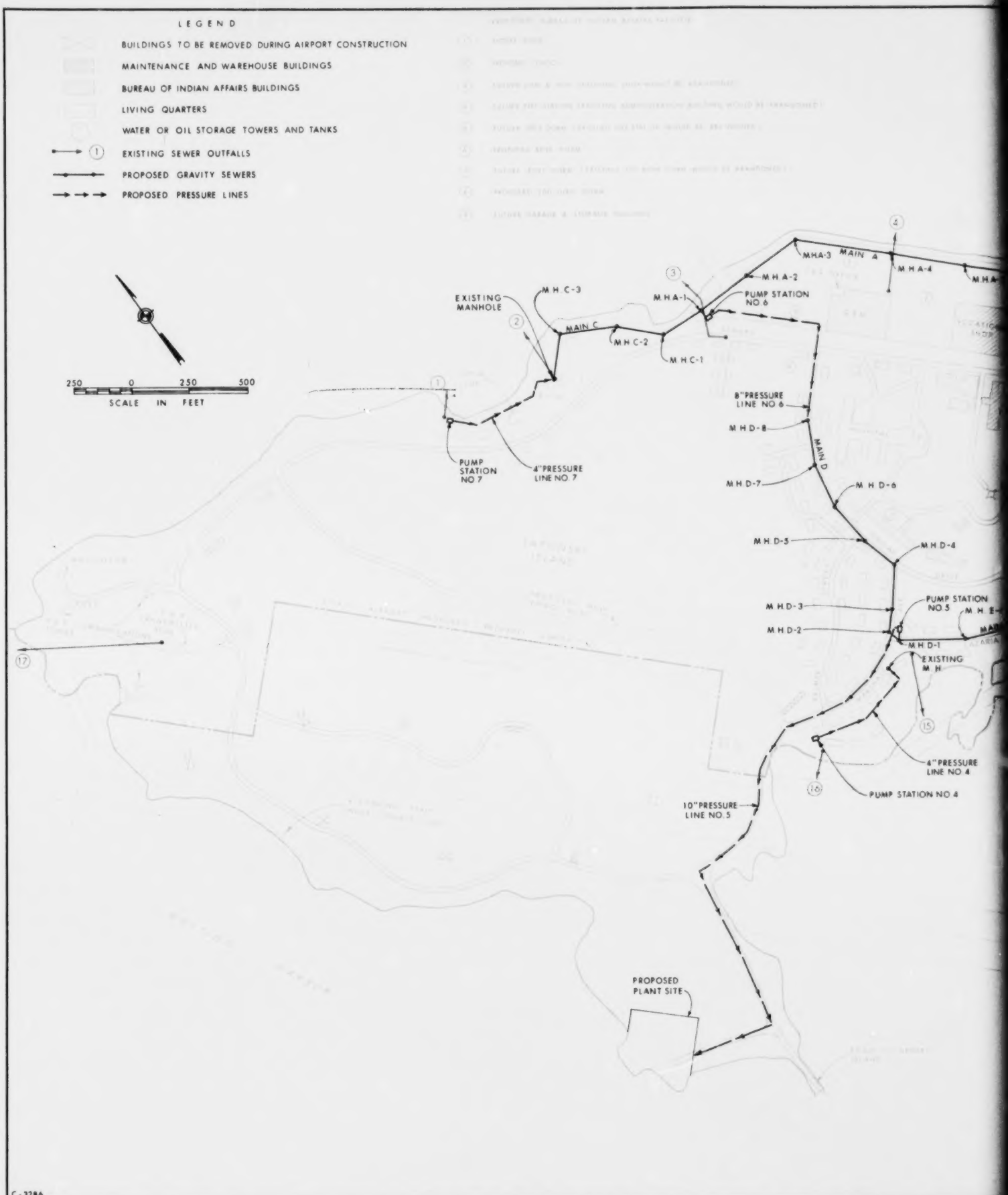
At Manhole A-1, Pump Station No. 6 would intercept Main A and Main C which carry all the sewage on the island, except for Outfall 17. This pump station would be a factory-built installation and would have the ability to pump at two different rates by adjusting the pump speed. At the higher speed, it would have a capacity of 800 gpm and at low speed a capacity of approximately 200 gpm. It would pump the sewage through a 10-inch pressure line to the proposed treatment plant site on the northwesterly end of the island.

At the present time, no sanitary facilities are in use at the FAA Transmitter Building; therefore, no interception of Outfall 17 is planned. However, if in the future it does become necessary to use sanitary facilities at this building, a submersible pump could pump the sewage directly to the treatment plant.

Plan B. Figure 11 shows the proposed sewerage system under Plan B where flow from the existing outfalls would be intercepted by means of sewage lift stations and new gravity sewer mains constructed for conveying all of the sanitary sewage to a sewage treatment plant site located on the tip of Japonski Island which projects beyond the proposed landing strip.

Pump Station No. 1 would be the same as under Plan A and would pump the sewage from Outfall 14 to the existing gravity sewer line that flows to Outfall 13.

Pump Station No. 2 would be the same as under Plan A, except that the 4-inch pressure line would discharge into a common 4-inch pressure line from Pump Station No. 3.


LEGEND
BUILDINGS TO BE REMOVED DURING AIRPORT CONSTRUCTION
MAINTENANCE AND WAREHOUSE BUILDINGS
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WATER OR OIL STORAGE TOWERS AND TANKS
1 EXISTING SEWER OUTFALLS
PROPOSED GRAVITY SEWERS
PROPOSED PRESSURE LINES
250 0 250 500
SCALE IN FEET
EXISTING MANHOLE
M H C-3
MAIN C
M H C-2
M H C-1
M H A-1
M H A-2
PUMP STATION NO 6
MHA-3
MAIN A
M H A-4
8"PRESSURE LINE NO 6
M H D-8
MAIN D
M H D-7
M H D-6
M H D-5
M H D-4
M H D-3
M H D-2
M H D-1
PUMP STATION NO.5
EXISTING M H
PUMP STATION NO 7
4"PRESSURE LINE NO. 7
4"PRESSURE LINE NO 4
PUMP STATION NO 4
10"PRESSURE LINE NO 5
PROPOSED PLANT SITE

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FIGURE 11

MT EDGECUMBE, ALASKA
SEWERAGE STUDY

PROPOSED SEWERAGE SYSTEM
PLAN B

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Pump Station No. 3 would be a factory-built type installation that would intercept flow from Outfall 12. It would have a capacity of 100 gpm and pump the sewage through a common 4-inch pressure line with Pump Station No. 2 and discharge into Manhole E-2 at the upper end of the new gravity sewer designated Main E.

Main E would be an 8-inch line that would carry the sewage from Outfalls 12, 12a, 13, and 14 to Pump Station No. 5.

Pump Station No. 4 would be the same as under Plan A and would pump sewage intercepted from Outfall 16 to the existing sewer that flows to Outfall 15.

Main A would be an 8-inch gravity sewer between Manhole A-13 and A-6. Between these manholes, it would intercept Outfalls 6 through 9 and Main B.

Main B would be an 8-inch gravity sewer for its entire length and intercept the sewage flow from Outfalls 11 and 10.

Main A would be a 10-inch line between Manholes A-6 and A-1 and intercept the sewage flow from Outfalls 3, 4, and 5. As under Plan A, both of these lines would be sized to carry all anticipated flow from proposed school expansions.

Pump Station No. 7 would be the same as under Plan A and would pump the sewage from Outfall 1 to Main C which would carry sewage flows from both Outfalls 1 and 2 to Manhole A-1.

At Manhole A-1, Pump Station No. 6 would intercept the sewage flow from Main A and Main C. It would be a factory-built type installation with a capacity of 500 gpm and would pump the sewage through an 8-inch pressure line to Manhole D-8 at the upper end of the new gravity sewer designated Main D.

Main D would be an 8-inch line for its entire length and carry the sewage to Pump Station No. 5

Pump Station No. 5 would intercept Outfall 15, Main D, and Main E, and would be a factory-built type installation capable of pumping at two different speeds and flow rates. At the higher speed, it would have a capacity of 800 gpm, and at the lower speed, a capacity of 440 gpm. This pump station would pump all sewage from the islands, except for Outfall 17, through a 10-inch pressure line to the treatment plant site located beyond the proposed landing strip.

If it becomes necessary to use the sanitary facilities at the FAA Transmitter Building at some future time, it does not appear practical to convey the wastes to the sewage treatment plant under Plan B because of distance and cost involved. Since flows are negligible from this installation, utilization of a septic tank and the existing outfall appears to be the best solution.

Plan C. Figure 12 has been prepared to show the proposed sewerage system under Plan C. Under this plan, the interception of wastes from the outfalls and the sewer collection system is identical to Plan A, except for the total pumping head at Pump Station No. 6 and the location of Pressure Line No. 6. Under Plan C, the sewage from the Federal Complex at Mt. Edgecumbe would be pumped to a sewage treatment plant located near the northerly City limits of Sitka. Pump Station No. 6 would be a factory-built sewage pump station equipped with two-speed pumps which would deliver 800 gpm at high speed and 270 gpm at the lower speed. Sewage would be discharged through a 10-inch pressure line across the Sitka Channel and up Katlian Avenue and Halibut Point Road to the combined treatment plant site.

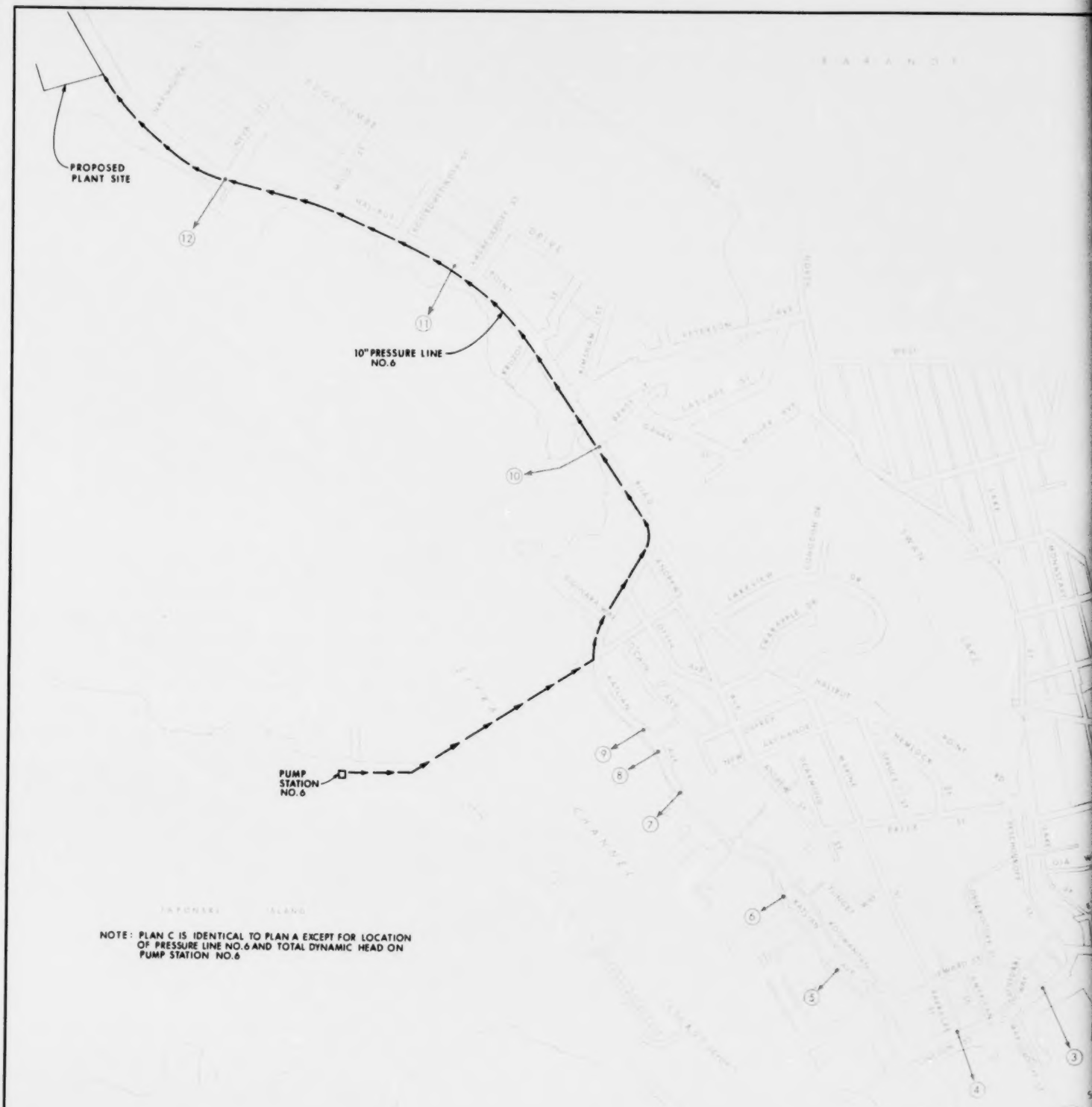
It is beyond the scope of this study to develop a plan for intercepting the Sitka outfalls and transporting the sewage. Neither of the two current reports prepared for the City by Hubbell & Waller or Carey & Kramer considered intercepting sewage flows from the City outfalls, whereby it could be conveyed to a sewage treatment plant. The City has, however, reduced the number of outfalls required to serve the present sewered areas of the City.

For the purpose of this report, it is assumed that the present and future sewage flows could be intercepted and pumped to a treatment plant located at the north City limits where it could be combined with the wastes from Mt. Edgecumbe and treated.

Proposed Airport Facilities. Any sanitary facilities constructed at the proposed airport would have to be pumped under any of the plans. Under Plan A, the wastes from the airport could be pumped directly to the treatment plant. Under Plans B and C, the wastes could be pumped to Pump Station No. 4.

SUMMARY

Table 3 summarizes the proposed sewerage systems under the various plans.



NOTE: PLAN C IS IDENTICAL TO PLAN A EXCEPT FOR LOCATION OF PRESSURE LINE NO. 6 AND TOTAL DYNAMIC HEAD ON PUMP STATION NO. 6

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FIGURE 12

MT EDGECUMBE, ALASKA
SEWERAGE STUDY

PROPOSED SEWERAGE SYSTEM
PLAN C

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TABLE 3

SUMMARY OF SEWER SYSTEM PLANS

Item	Plan A	Plan B	Plan C
Total length of gravity sewers	5,100 ft.	6,300 ft.	5,100 ft.
Total length of pressure line	6,650 ft.	7,950 ft.	11,150 ft.
Capacities of pump stations:			
Pump Station No 1	50 gpm	50 gpm	50 gpm
Pump Station No. 2	100 gpm	100 gpm	100 gpm
Pump Station No. 3	150 gpm	100 gpm	150 gpm
Pump Station No. 4	50 gpm	50 gpm	50 gpm
Pump Station No. 5	200 gpm	800 gpm	200 gpm
Pump Station No. 6	800 gpm	500 gpm	800 gpm
Pump Station No. 7	50 gpm	50 gpm	50 gpm

CHAPTER IV

SEWAGE TREATMENT CONSIDERATIONS AND DESIGN CRITERIA DEVELOPMENT

PRESENT SITUATION

At the present time, all sewage from both the Mt. Edgecumbe Federal Complex and the City of Sitka is discharged untreated into the waters of Sitka Sound. No prior studies have been made to determine the need or requirements for treatment of sewage from the Mt. Edgecumbe Complex. Previous studies have been made, however, relative to the sewerage system serving Sitka.

The most recent studies at Sitka were made by Hubbell & Waller Engineering Corporation, Consulting Engineers, Seattle, Washington, and Carey & Kramer, Consulting Engineers, Seattle, Washington. The Hubbell & Waller report[1] was a planning report prepared for use as a general guide for the future development of Sitka and included a section on Sewers and Drainage. This particular section of the report, dated 3 November 1955, amended to 1 October 1957, and further amended to 21 May 1958, states:

> "The city's sanitary sewer system should be improved and extended to furnish adequate service to all residents, both present and future. Adequate sewage disposal is provided by easy access to the tidelands in front of Sitka where the salty Pacific Ocean tides can sweep it away. Sanitary sewer outfalls can be extended over the tidelands to below the line of mean lower low water where the outfall is submerged at all times. Outfalls must be so situated that the greatest advantage can be taken of these tides.
>
> "No expensive sanitary sewage disposal plant is required at Sitka, either now or in the future, for any foreseeable population that might settle in the Sitka area."

The Carey & Kramer report[2] covered only problems associated with the sewer system and did not make any mention of disposal other than noting that several of the existing outfalls did not extend past the mean lower low water line.

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(1) "A Comprehensive Plan for Present and Future Development," Sitka Alaska, Hubbell & Waller Engineering Corporation, 1958.

(2) "Preliminary Engineering Report," City of Sitka, Carey & Kramer 1962.

PRESENT AND FUTURE REGULATORY AGENCY POLICY

The State Water Pollution Control Agency in Alaska is the Division of Public Health of the State of Alaska, Department of Health and Welfare. A letter from the Division of Public Health (Appendix B) makes no recommendations on specific requirements for treatment of wastes discharged to the waters of Sitka Sound from the Mt. Edgecumbe-Sitka sewer systems. However, a minimum of primary treatment is required for the waters of Alaska. This provision is made in the Water Quality Objectives portion of the Alaska Administrative Code.

The Federal Water Pollution Control Act (33 USC 466h), contemplates a Federal program in cooperation with State and interstate agencies and municipalities for the control and abatement of water pollution emanating from Federal installations.

The President, in a memorandum dated 13 May 1960, emphasized that the Federal establishment must point the way for the rest of the nation by making certain its own house is in order with reference to the preventing and controlling of water pollution attributable to wastes discharged from Federal installations. Section 9 of the Federal Water Pollution Control Act further declares that it is the intent of Congress that all Federal departments or agencies cooperate with the Department of Health, Education, and Welfare, and with any other water pollution control agency in preventing water pollution caused by Federal properties.

Technical guidelines have been established by the U. S. Public Health Service to implement the water pollution control abatement measures at Federal installations. These guidelines state that, in general, Federal installations should provide secondary treatment or its equivalent for all wastes except cooling water. However, in cases where the Public Health Service and the state water pollution agency concerned agree that a lesser degree of treatment is adequate to protect the quality of the receiving waters, a lesser degree of treatment may be provided. The technical guidelines clarify "lesser degree of treatment" by stating that under no circumstances will less than primary treatment or its equivalent be permitted.

RECREATIONAL AND AESTHETICAL CONSIDERATIONS

A large number of persons living in Sitka and at the Mt. Edgecumbe Federal installation own boats of some kind and spend many hours at

salt water fishing, both commercially and for sport. The boats are also used for transportation to the various hunting areas in the vicinity. It was reported that some water skiing and scuba diving is done in the area, but only to a minor extent and cannot be considered as a major recreational activity. No actual swimming activities were observed during visits to the area in July and September. Administrative personnel at the B. I. A. school did indicate that native children attending school had to be prevented from swimming in Sitka Channel occasionally. While there is little swimming done in the area, the children at Mt. Edgecumbe and Sitka do play along the beaches.

There appears to be no significant public health hazard to persons using boats in the area. A potential health hazard does exist, however, to children and other persons who frequent the beaches in the immediate vicinity of the numerous sewer outfalls, and particularly when the ends of the outfalls are exposed or nearly exposed.

The accumulation of solids near the ends of the outfalls not extended below lower low water is objectionable not only from a public health standpoint, but also from an aesthetic standpoint. Floating material discharged through the outfalls and not broken up by the waves and wind is also unsightly. Floating materials which eventually wash ashore could become objectionable; however, no objectional quantities of floating material were being carried ashore in the immediate Mt. Edgecumbe-Sitka vicinity when observations were made in July and September.

OCEANOGRAPHIC CONSIDERATIONS

Marine Biology. As indicated in the letter from the State of Alaska Department of Fish and Game (Appendix B), the present practice of discharging untreated sewage from sewers serving the Mt. Edgecume installation and the City of Sitka does not appear to constitute an immediate hazard to the many species of marine life inhabiting Sitka Sound. No evidence was found to support the possibility of infected invertabrates or fishes in Sitka Sound spreading infectious diseases.

Tides. The tide range in the Mt. Edgecumbe-Sitka area, the difference between mean low water and mean high water, is 7.7 feet, and the estimated extreme range is about 14 feet. The volume of water associated with a tide range of this magnitude is so great in relation to the volume of sewage being discharged that it is felt that no significant change could be detected in the quality of the water in Sitka Sound.

except in the immediate vicinity of the outfalls at low tides. No volume of water associated with tide changes, however, can eliminate the problems of floating materials previously discussed.

Currents. Once sewage fields (a stratified layer of diluted sewage) or floating materials reach the water surface, the prevailing surface currents influenced by the wind in the area become the main concern. These prevailing surface currents in Whiting Harbor and Sitka Channel were reported to be to the northwest. This was verified by visual observation of trash dumped into Whiting Harbor floating out of the harbor and floating material in Sitka Channel moves through the channel in a northwesterly direction. These currents are consistent with the prevailing winds in the area which are from the east and southeast.

Because of the prevailing currents, Outfalls 9 through 16, serving the Mt. Edgecumbe Federal installation, and Outfalls 1 through 4, discharging into Sitka Bay from Sitka, are not ideally located from the standpoint of protecting the shore areas from bacterial contamination or floating materials.

Letter. A letter from Professor Robert O. Sylvester relative to oceanographic considerations is included in Appendix B.

TREATMENT REQUIREMENTS

To ensure against contamination of the shore areas in the vicinity of the numerous existing outfalls, it is recommended that primary treatment be provided all sewage prior to discharge into Sitka Sound. This will comply with the minimum requirements of all regulatory agencies.

DESCRIPTION OF TREATMENT METHODS

The following explanation of the problems and procedures of sewage treatment is offered to provide a basis for understanding the degree of sewage recommended in this report.

Results to be Obtained. A typical sewage contains domestic and industrial wastes in amounts and composition that vary throughout the day. Grease, oil, sand, and small gravel also find their way into the sewers. Primary treatment involves the removal of suspended and settleable solids by screening, flotation, and sedimentation. Secondary treatment involves the decomposition of the dissolved or very finely divided suspended organic matter which remains in the sewage even after treatment by primary treatment processes. The materials removed in both the primary and secondary treatment processes, such as grit, screenings, grease, and the settled solids, must be disposed of in an inoffensive manner.

Primary Treatment. Treatment units generally provided at primary sewage treatment plants include grit chambers, sewage shredders, clarifiers, sludge digesters, and sludge disposal facilities.

Grit removed usually does not require further special treatment prior to disposal. Larger solids, rags, etc., which can clog pumps and piping are shredded by a sewage shredding device and returned to the sewage flow for removal in the clarifiers.

Grease and settleable solids in the sewage are continuously removed by floatation and sedimentation in clarifiers, as this organic matter would putrefy if not removed quickly and treated. The process generally consists of quiescent settling of the sewage for a period of approximately two hours, during which time approximately 60 percent of the suspended matter in the sewage is removed. The oxygen requirement of the sewage is also reduced approximately 30 percent.

Solids removed in the clarifiers are transferred to closed digestion tanks where complete bacterial decomposition takes place, converting the highly putrescible solids into a relatively stable humus-like material in 30 to 90 days. After these materials are digested, they are withdrawn from the tank and discharged onto sand beds, mechanically dewatered, spread on land as liquid fertilizer, or stored in lagoons.

The sludge dries rather quickly in dry weather and is generally inoffensive. After drying, it can be used as fill, disposed of locally as fertilizer, or burned in an incinerator. Digested sludge can also be trucked to fields and spread as a liquid. In either the dry or liquid state, digested sludge has some fertilizer value and, in addition, acts as a soil conditioner

Figure 13 shows a typical primary treatment plant with grit removal, shredder, clarifier, and sludge digestion facilities. The plant shown serves the City of Hood River, Oregon.

Combined clarifier and digestion tanks can be used in some locations for primary treatment. These plants, in smaller sizes, can generally be built at less cost than plants with separate clarifier and digestion tanks, and require less mechanical equipment. Figure 14 shows a treatment plant with combined clarifier and digestion tank which serves the City of Raymond, Washington.

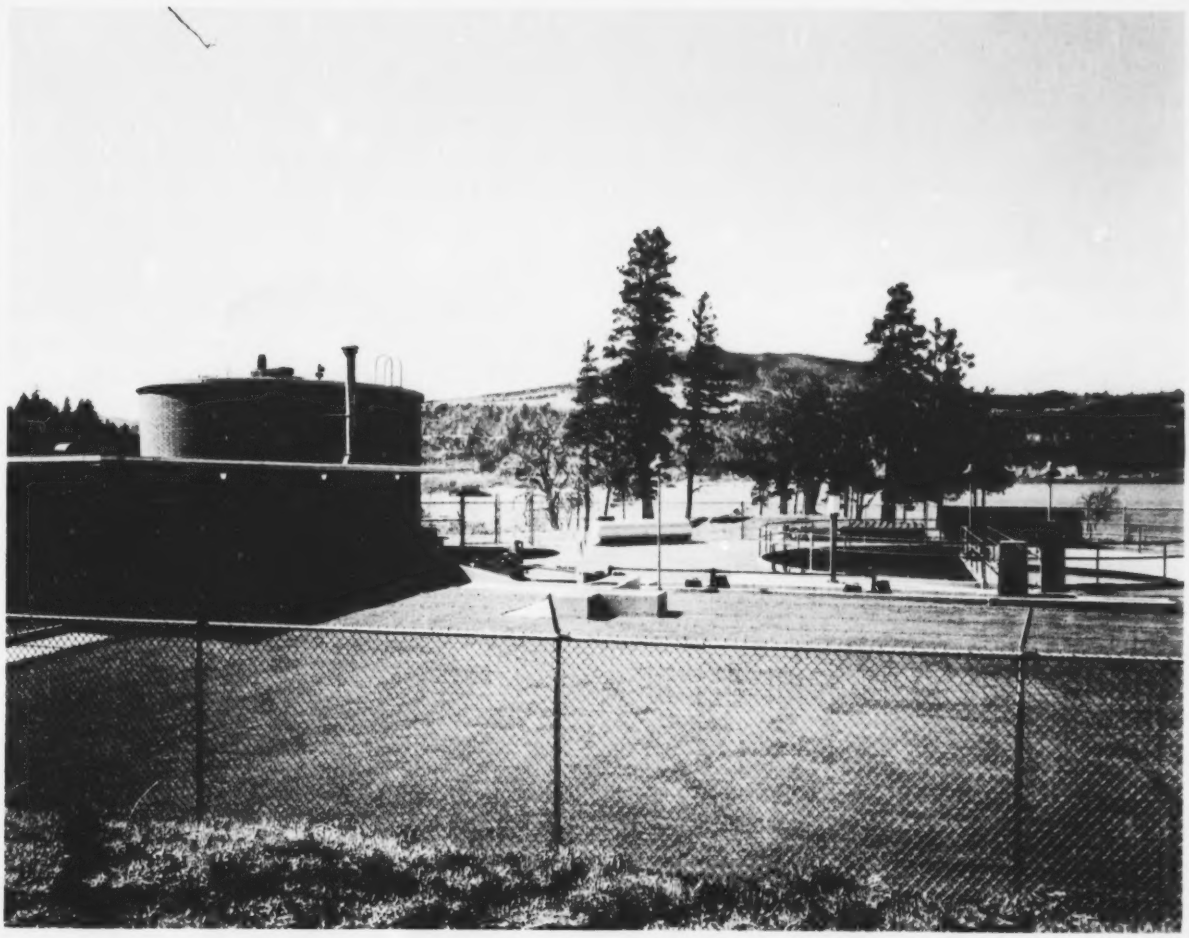

FIGURE 13

MT. EDGECUMBE, ALASKA
SEWERAGE STUDY

TYPICAL PRIMARY SEWAGE TREATMENT PLANT

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SEATTLE PORTLAND CORVALLIS BOISE

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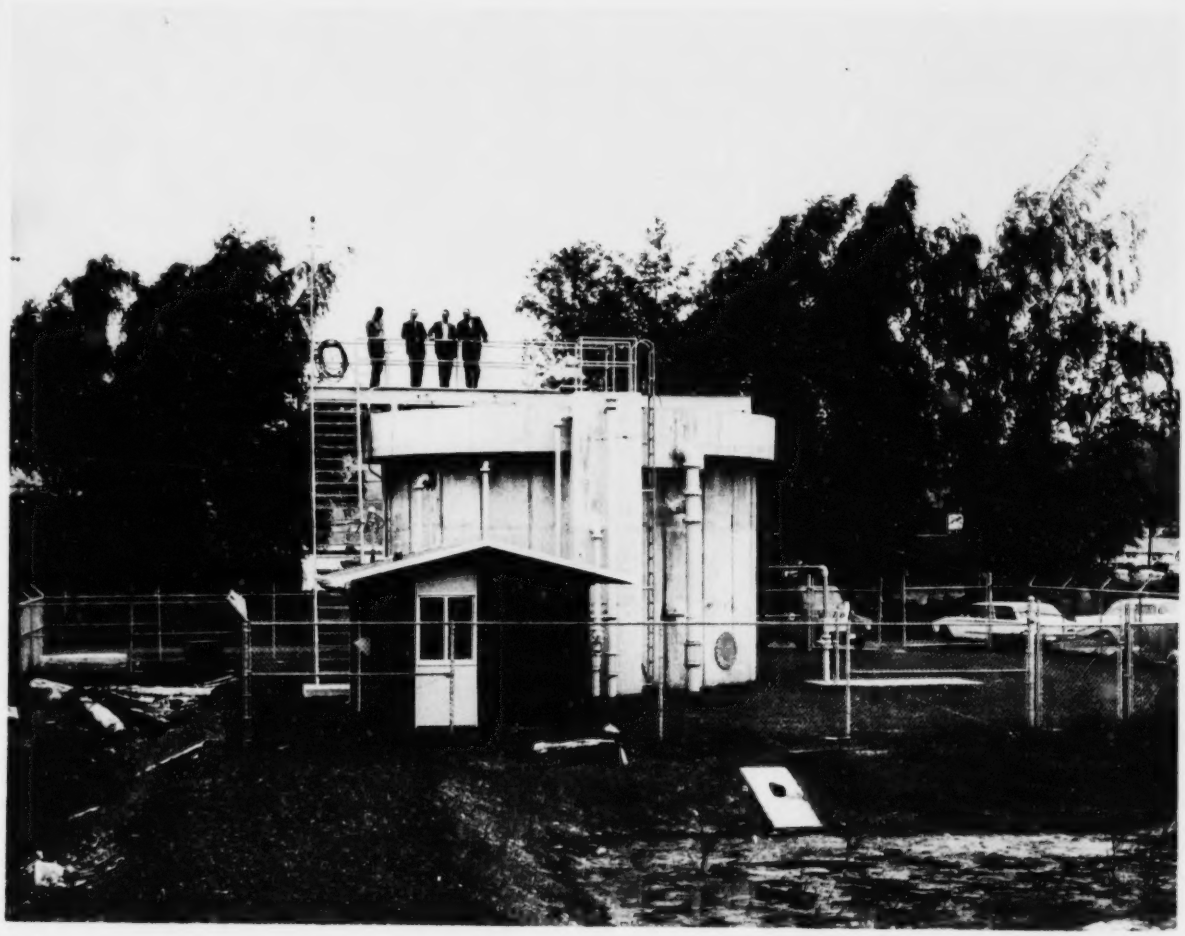

FIGURE 14

MT. EDGECUMBE, ALASKA
SEWERAGE STUDY

PRIMARY SEWAGE TREATMENT PLANT WITH
COMBINED CLARIFIER & DIGESTION TANK

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Secondary Treatment. Additional treatment, called secondary treatment, is usually required where the strength and quantity of the sewage is high and the receiving body of water is not considered capable of providing sufficient dilution of the effluent from a primary treatment plant. Where secondary treatment is required, it is accomplished in one of several ways. In all cases, the main function is to furnish a sufficient supply of oxygen to support aerobic decomposition of the organic matter remaining in the sewage after primary treatment.

The principal methods employed in modern secondary sewage treatment are as follows:

1. Activated sludge processes
2. High rate trickling filters
3. Low rate trickling filters

Of these methods, high rate trickling filters are usually the most economical from a construction and operating cost standpoint. The high rate filtration process is accomplished by distributing the sewage effluent from the primary portion of the plant over a rock filter bed until sufficient bacterial action has occurred to render the resulting effluent relatively stable. Figure 15 shows a high rate trickling filter type sewage treatment plant for providing secondary sewage treatment at McMinnville, Oregon. The trickling filter is the circular structure at the upper left hand side of the picture.

Recently, a process employing principles similar to activated sludge has been developed for sewage treatment at small communities, schools, institutions, and trailer parks. This process, called extended aeration, accepts all solids at one treatment unit and carries out the functions of both the primary and secondary treatment plant. Destruction of organic material is accomplished by adding excess amounts of air to the sewage. All sewage is aerated for a period of 24 hours, with enough air to oxidize the organic material carried in the sewage. Separate digestion tanks or sludge disposal facilities are not required as the organic material is sufficiently reduced by oxidation in the aeration process.

The equipment costs for this process are high. The necessity to supply large amounts of air which are required for this process also results in relatively high operational costs.

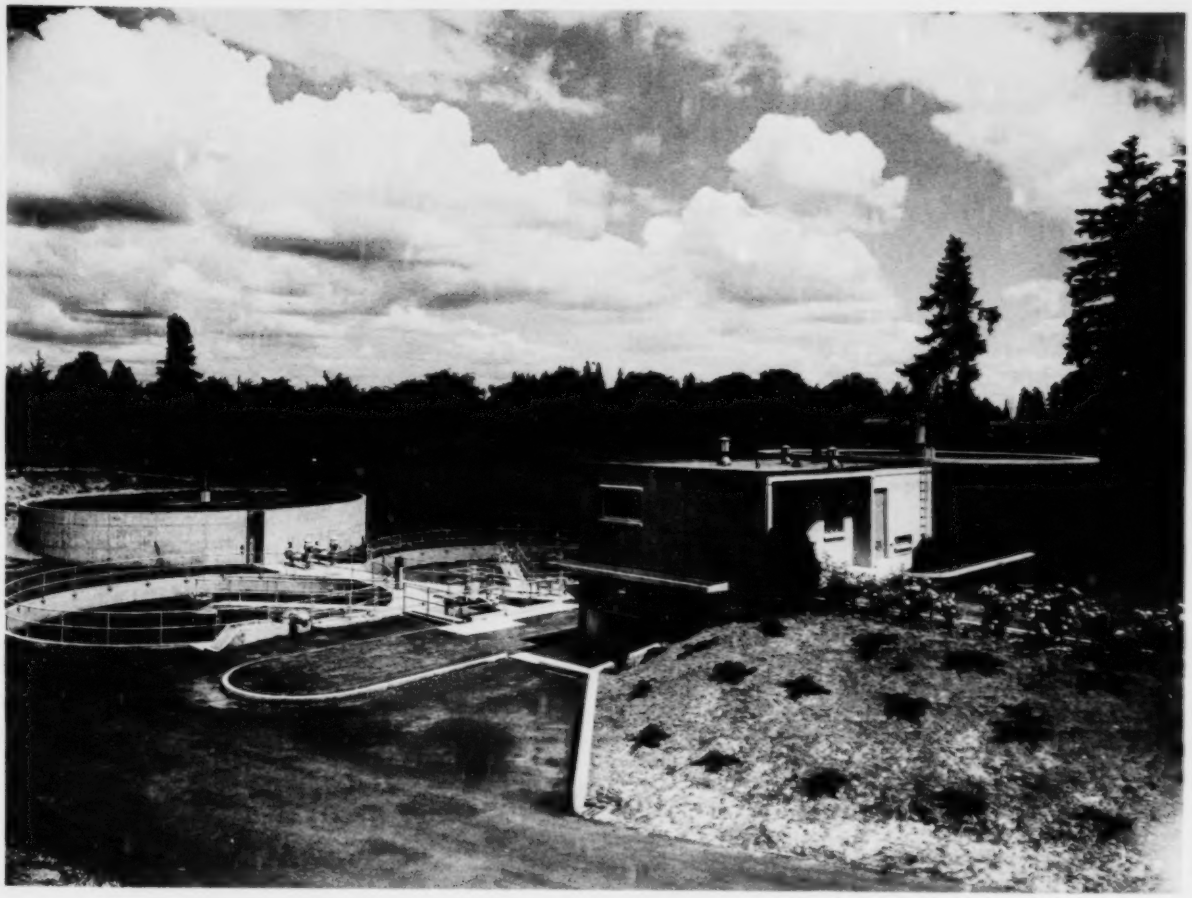

FIGURE 15

MT. EDGECUMBE, ALASKA
SEWERAGE STUDY

SECONDARY SEWAGE TREATMENT PLANT
WITH HIGH RATE FILTER

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POPULATION PROJECTIONS

General. Sewage treatment facilities are commonly designed for a period of 15 to 20 years in the future based on the anticipated sewage flow and the strength of the sewage. Determination of future sewage flows for design purposes, therefore, generally becomes a problem of population forecasting. For this report, the year 1982 has been used as the basis for sizing the initial treatment facilities.

There are several methods presently used to predict future populations of municipalities, however, these are not applicable in estimating future populations at Federal installations similar to Mt. Edgecumbe. Therefore, the population projection for Mt. Edgecumbe and the City of Sitka were considered and are discussed separately.

Mt. Edgecumbe. The present population of the Mt. Edgecumbe Federal installation is estimated at approximately 1,800 persons. This population is made up of the native students attending the B. I. A. school; USPHS hospital patients; B. I. A., USPHS, and FAA personnel and their families.

Any increase in population would have to be based on the assumption that a continuing need will exist for the services now rendered by the three Federal agencies with facilities at Mt. Edgecumbe and that the present facilities will be expanded.

By interviewing the local administrative personnel of the three agencies, it was determined that only the Bureau of Indian Affairs had plans for increasing facilities for an additional 500 students at the boarding school. It was indicated that an increase in this number of students would require an additional staff of 32 persons. A time schedule for the B. I. A. expansion had not been formulated.

The construction of the airport will cut off access to the islands in Whiting Harbor in addition to eliminating approximately 75 acres on Japonski Island now used for recreational purposes. Reduction of this area previously available for recreation will be a major factor in programming expansion of the B. I. A. facilities. The reduction of area for recreation could also limit enrollment at the school to 1,000 students instead of 1,200 as planned. For sewerage planning purposes, however, it has been assumed that the future enrollment at the school will be 1,200.

No expansion of the USPHS hospital is anticipated at this time or within the foreseeable future. Present methods of treating patients

with tuberculosis has decreased their required stay at the hospital and this is the primary reason a need for expansion of the hospital facilities does not exist.

Operation of the FAA facilities at Mt. Edgecumbe will continue with little change in the number of personnel.

Since the only significant change in population at the Mt. Edgecumbe Federal installation is dependent on the number of students enrolled at the B. I. A. boarding school, the population of Mt. Edgecumbe in the year 1982 has been projected as approximately 2,500 persons.

City of Sitka. The Alaska State Housing Authority completed a comprehensive development plan for the City of Sitka in March of 1963. Most of the data contained in the report dates from 1962 with population projections made to the year 1980.

The above report forecasted a population for the City of Sitka in the year 1980 of 7,150. This forecast was based on available employment in the area and assumed a continuing stable employment base in which increased job opportunities would continue to exist.

After reviewing the above study, it appears that a projection of the City's population at a rate of growth between 3.5 to 4.0 percent compounded per year would be reasonable. The population forecasts shown on Figure 16 for the City of Sitka were developed by compounding the 1962 population of 3,640 at growth rates of 3.5 and 4.0 percent per annum. The population forecast by the Alaska State Housing Authority is also shown on Figure 16.

A projected population for Sitka in the year 1982 has been assumed as 8,000 persons for the purpose of sizing sewage treatment facilities.

EXISTING SEWAGE CHARACTERISTICS

Knowledge of the characteristics of the sewage to be treated is a prerequisite for planning and design of waste treatment facilities. To determine the characteristics, biochemcial oxygen demand (BOD), tests were run on composited samples of sewage collected at Outfalls 6 and 15. The BOD was 230 parts per million (ppm) at Outfall 15 and 320 ppm at Outfall 6. From these tests, it was apparent that the Mt. Edgecumbe sewage can be classified as a typical domestic sewage.

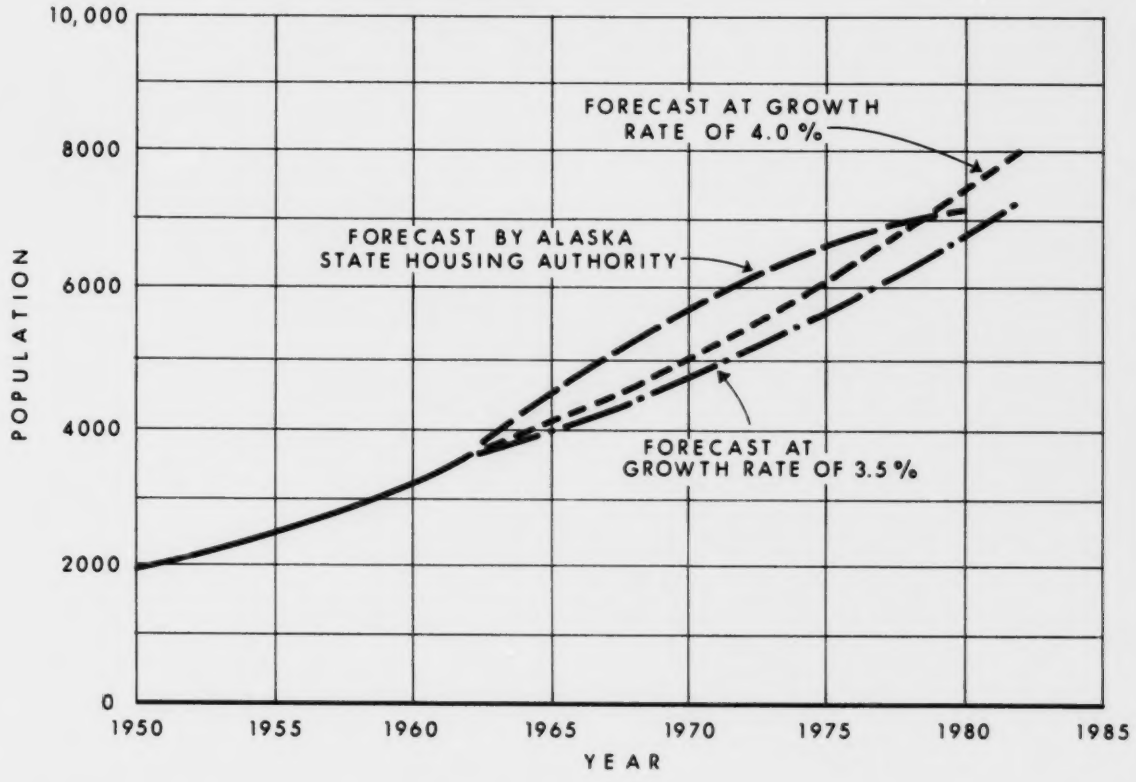

FIGURE 16

MT. EDGECUMBE, ALASKA
SEWERAGE STUDY

SITKA POPULATION FORECAST

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The higher BOD of the sewage from the area served by Outfall 6 was due to ground garbage in the wastes being discharged from the kitchens at the hospital and the B. I. A. boarding school cafeteria.

The USPHS hospital is a modern general hospital equipped and staffed for both in-patient and out-patient services. Dr. Wagnon, Medical Officer-in-Charge, reported that wastes from patients with communicable diseases were sterilized prior to disposal. Therefore, special treatment of the hospital waste is not required and can be combined with the other sewage and treated as a typical domestic sewage.

City of Sitka. Sewage discharged through the City outfalls is typical domestic sewage and contains no industrial wastes.

Two fish canneries operating in Sitka do not discharge their industrial wastes into the City sewer system. One cannery, Katlian Packing Corporation, discharges all of their wastes directly into Sitka Channel. The other cannery, Sitka Cold Storage, deposits their solid wastes in a gurry scow and then tows the scow out to sea where the solids are dumped.

The canneries, if connected to the City sewers, should be required to separate the solid waste material produced in their processing. The process liquid waste could then be accepted in the City sewers and would be compatible for treatment in a conventional sewage treatment plant when combined with the domestic sewage. Unpolluted waste cooling water from the canneries could continue to be discharged to Sitka channel.

DESIGN CRITERIA

Based on previously discussed sewage characteristics, anticipated flows, and future population projections, the treatment plant design criteria shown in Table 4 have been developed for use in sizing treatment units for providing primary treatment of the sewage under Plans A, B, and C. A design period of 15 years or until approximately 1982 has been used.

Under Plan A, the primary sewage treatment plant would be constructed in conjunction with interceptor sewers, and pump stations proposed under Plan A in Chapter III. The plant would be designed only for treatment of the sewage from the Mt. Edgecumbe Federal installations on Japonski, Alice, and Charcoal Islands.

TABLE 4

SEWAGE TREATMENT PLANT DESIGN CRITERIA

Item	Plan A		Plan B		Plan C	
	Present	1982	Present	1982	Present	1982
Population						
Mt. Edgecumbe	1,800	2,500	1,800	2,500	1,800	2,500
Sitka					4,100	8,000
Design Population		2,500		2,500		10,500
Sewage Flow						
Mt. Edgecumbe[1]						
Average (mgd)	0.26	0.33	0.26	0.33	0.26	0.33
Maximum (mgd)	0.89	1.11	0.89	1.11	0.89	1.11
Sitka[2]						
Average (mgd)					0.61	1.20
Maximum (mgd)					2.14	4.20
Design Flow						
Average (mgd)		0.33		0.63[4]		1.53
Maximum (mgd)		1.15[3]		1.15[5]		5.31

[1] From Table 2, Chapter III

[2] Based on 150 gallons/capita/day

[3] Based on Maximum Pump Capacity of Pump Station No. 6

[4] Based on Minimum Pump Capacity of Pump Station No. 5

[5] Based on Maximum Pump Capacity of Pump Station No. 5

The Plan B plant would be constructed in conjunction with interceptor sewers and pump stations proposed under Plan B in Chapter III. This plant would also be designed only for treatment of the sewage from Mt. Edgecumbe.

The Plan C plant would be constructed in conjunction with interceptor sewers and pump stations proposed under Plan C in Chapter III. This plant would be sized for the treatment of the combined sewage flow from Mt. Edgecumbe and Sitka.

PLANT SITE CONSIDERATIONS

Selection of suitable sites for sewage treatment facilities involved the consideration of several factors. The principal of these were land area requirements, land use of adjacent areas, prevailing currents in Sitka Sound, direction of prevailing winds in the area, availability of existing roads for access, site adaptability as regards tide elevations and suitability of the site in relation to intercepting and conveying sewage to the site.

During this study, several sites on Japonski Island were considered. It was concluded that the best site is the site selected for Plan A which would be located near the northwesterly tip of Japonski Island. (See Figure 10.) The site selected for Plan B (See Figure 11) is less attractive because of the location of the proposed airport. Location of treatment plant facilities on this site would require crossing an active runway to gain access to the plant. A letter from the Department of Public Works, Division of Aviation, which is included in Appendix B, assures that access to treatment facilities at this site would be granted to the Federal Government by the State.

The site for construction of treatment facilities to treat the combined Mt. Edgecumbe-Sitka sewage would be located just north of the City of Sitka City limits between Halibut Point Road and Sitka Channel. (See Figure 12.) Essentially, all the land along the coast between the City limit lines has been occupied. therefore, an area for a more centrally located site is not available. If the present seaplane turnaround was abandoned, the area could be used for a sewage treatment plant site. The existing commercial and residential development in the immediate vicinity, however, could cause public relations problems. Since definite plans for abandoning the turnaround have not been developed, the site beyond the north City limits was selected for Plan C in this report.

DESCRIPTION OF TREATMENT FACILITIES

Facilities Common to All Plans. Each plan for providing treatment facilities requires that some portions of the interceptor sewers, pump stations, and pressure lines be designed particularly for that individual system. In each case, a comprehensive preliminary design has been made for each treatment facility so that a detailed cost estimate could be made.

Portions of each plan associated primarily with the interception of existing sewers are similar, regardless of the treatment plan selected. The interception and pumping stations have been discussed previously in Chapter III and layouts of each plan are shown on Figures 10, 11, and 12.

Tables 5 and 6 show the design factors developed for these treatment plans.

Plan A. Under Plan A, all sewage would be pumped from Pump Station No. 6 to the treatment plant site as shown on Figure 10.

The plant would consist of a combination clarifier and digester unit preceded by a sewage grinding mechanism, bypass bar screen, and flow measurement facilities. Figure 17 shows a typical layout for such a plant. The effluent would be discharged into Sitka Channel. A covered sludge drying bed would be provided. A control building would house a sludge pump, electrical equipment, and minimum laboratory and sanitary facilities. The plant site would be fenced to prevent vandalism and a new access road to the mausoleum provided. Figure 14 shows a plant similar to the type proposed except for the covered sludge drying beds.

Plan B. Under Plan B, all sewage would be pumped from Pump Station No. 6 to the treatment plant site as shown on Figure 11.

The plant would have a layout similar to that shown on Figure 18 and would be similar to the plant described under Plan A, except for slight changes in the dimensions of the combination clarifier and digester unit to accommodate a higher design flow. The plant outfall line would discharge into Whiting Harbor. All structures would be below the height limitations set forth in the letter from the Division of Aviation which is included in Appendix B.

Plan C. Under Plan C, all sewage from both Mt. Edgecumbe and the City of Sitka would be pumped to a common treatment plant site. (See Figure 12.)

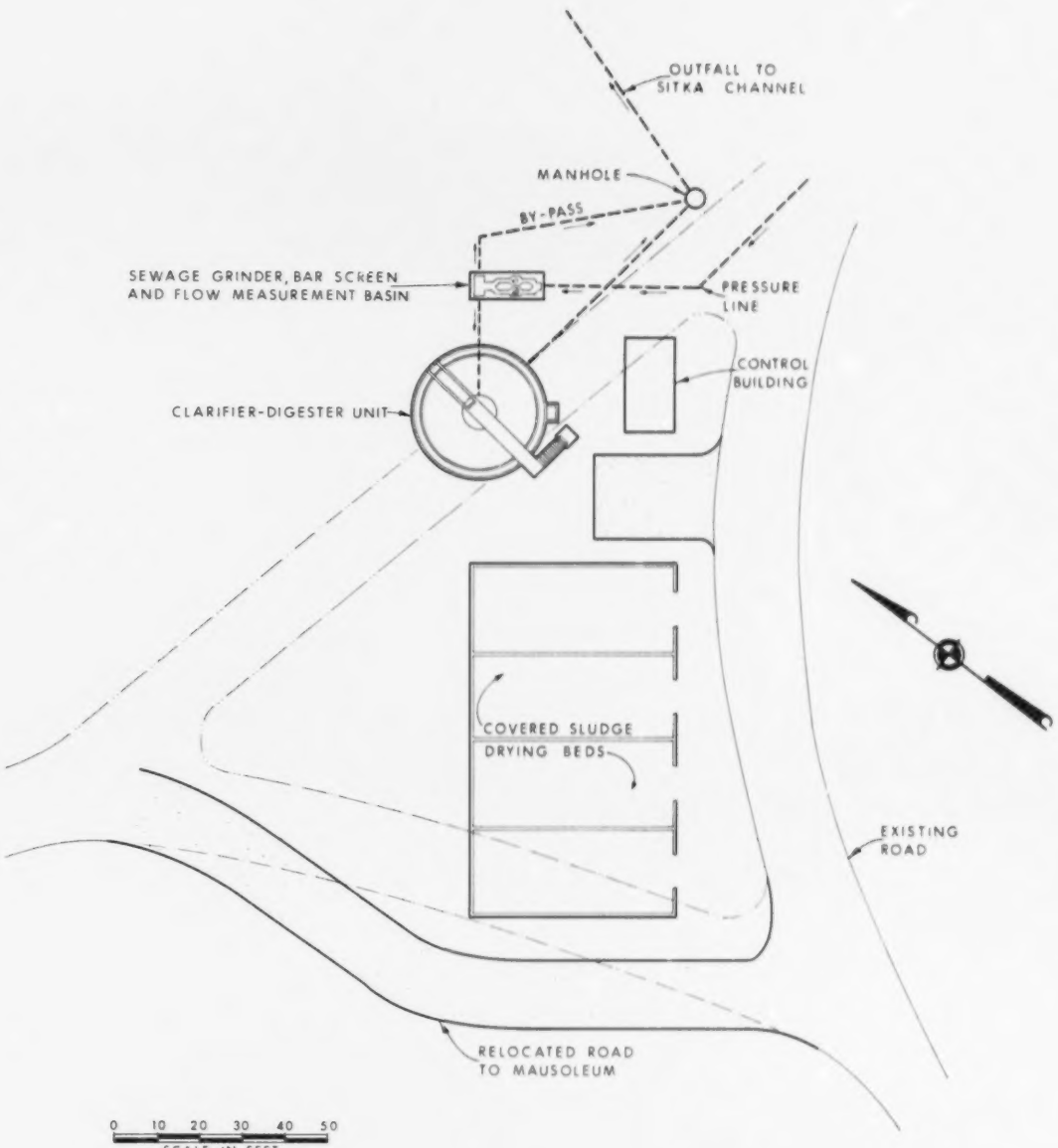

FIGURE 17

MT. EDGECUMBE, ALASKA
SEWERAGE STUDY

PROPOSED SEWAGE TREATMENT PLANT
PLAN A

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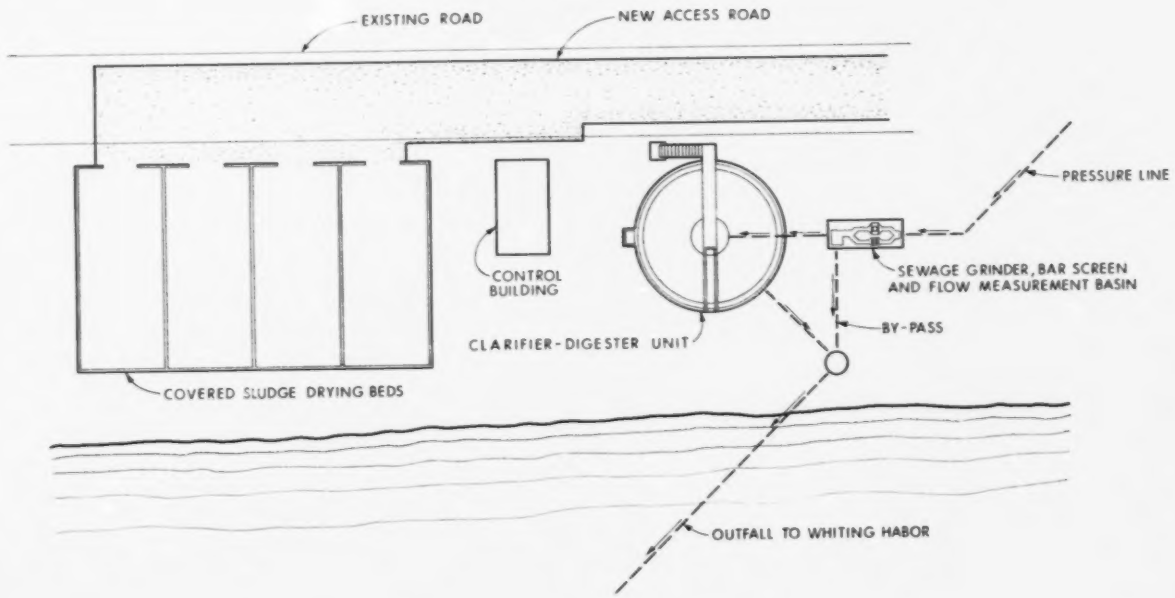

FIGURE 18

MT. EDGECUMBE, ALASKA
SEWERAGE STUDY

PROPOSED SEWAGE TREATMENT PLANT
PLAN B

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TABLE 5

DESIGN FACTORS
FOR
PLANS A & B SEWAGE TREATMENT FACILITIES

Item	Plan A	Plan B
Design Population	2,500	2,500
Design Flow		
Average (mgd)	0.33	0.63
Maximum (mgd)	1.15	1.15
Sewage Grinder		
Number	1	1
Hydraulic Capacity (mgd)	1.50	1.50
Flow Measurement		
Number	1	1
Type (V-notch Weir)	90°	90°
Clarifier-Digester Unit		
Number	1	1
Diameter (feet)	28	30
Overflow Rate at Avg. Flow (gal/sq ft/day)	540	890
Detention Time at Avg. Flow (hrs)	2-1/2	2
Sludge Storage Volume (cf)	10,000	10,000
Volume per Capita (cf)	4	4
Covered Sludge Drying Beds		
Number	4	4
Size (Width x Length in Feet)	20 x 47	20 x 47
Total Area (sq ft)	3,760	3,760

TABLE 6

DESIGN FACTORS
FOR
PLAN C SEWAGE TREATMENT FACILITIES

Item	Plan C
Design Population	
Mt. Edgecumbe	2,500
Sitka	8,000
Total	10,500
Design Flows	
Average (mgd)	
Mt. Edgecumbe	0.33
Sitka	1.20
Total	1.53
Maximum (mgd)	
Mt. Edgecumbe	1.11
Sitka	4.20
Total	5.31
Grit Basin	
Number	1
Size (width x length, in feet)	12 x 12
Hydraulic Capacity (mgd)	5.75
Sewage Grinder	
Number	1
Hydraulic Capacity (mgd)	7.5
Flow Measurement	
Number	1
Type	Parshall Flume
Hydraulic Capacity (mgd)	10.4
Clarifier	
Number	1
Diameter (feet)	50
Overflow Rate at Average Flow (gal/sq ft/day)	780
Detention Time at Average Flow (hrs)	2
Digesters	
Number	2
Diameter (feet)	30
Total Volume (cf)	31,500
Volume per Capita (cf)	3

The plant flow would enter through a grit basin followed by a sewage grinding mechanism. A Parshall flume flow measurement facility, separate clarifier, and 2-stage sludge digestion facilities would also be provided. Figure 19 shows a tentative layout for such a plant. The effluent would be discharged into Sitka Channel.

The primary digester would be equipped with a sludge mixer and heat exchanger. A floating gas holder type cover would be provided on the secondary digester.

A control building would house a raw sludge pump, a sludge transfer pump, electrical equipment, combination sludge gas and oil-fired boiler, laboratory, locker room with shower and sanitary facilities, storage room, and an office.

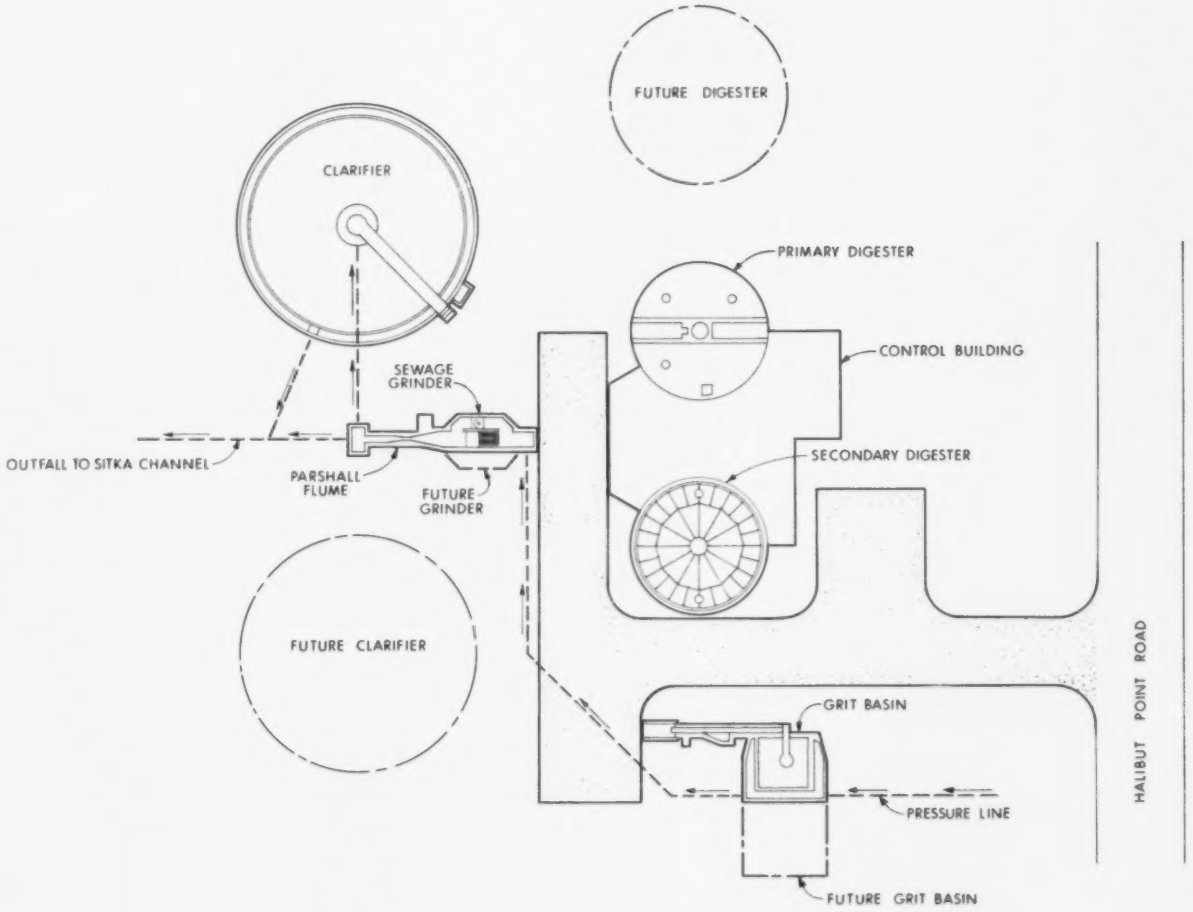

FIGURE 19

MT. EDGECUMBE, ALASKA
SEWERAGE STUDY

PROPOSED SEWAGE TREATMENT PLANT
PLAN C

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SEATTLE PORTLAND CORVALLIS BOISE

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CHAPTER V

COMPARISON OF PLANS

CONSTRUCTION AND OPERATING COSTS

A summary of cost estimates for all plans appears in Table 7, and detailed cost estimates for each plan appears in Appendix C.

Considerable rock excavation is anticipated in construction of the projects under consideration. In addition, bad groundwater conditions in some areas can be expected to create further difficult construction problems. Because of these construction problems involved, a wide range in bids is probable on the construction. The estimates of cost for making cost comparisons were developed from a detailed analysis of all known factors and probable construction difficulties. All cost estimates are based on the expected 1966 cost index and include an allowance of 30 percent for design engineering, field surveying, construction supervision, inspection during construction, administration, legal costs, and contingencies.

Estimates of operation and maintenance costs are based on experience with similar type facilities and the best available information as to operation, personnel, and maintenance requirements. The operation and maintenance costs for each plan are summarized in Table 8.

COMPARISON ON ANNUAL COST BASIS

Table 7 was developed for comparison of all plans for serving Mt. Edgecumbe on a total annual cost basis. For illustrative purposes, revenue for financing the construction was assumed to be furnished by 25-year bonds with an interest rate of 5 percent. Principal and interest payments were computed from capital recovery tables.

On a net capital cost basis, Plan A would be the least expensive for collecting and treating wastes from Mt. Edgecumbe. From an annual cost standpoint, however, Plan C becomes the most desirable plan to follow. This is because of the reduced annual operating costs which would result from the benefits of joint operation of a sewage treatment plant with the City of Sitka.

TABLE 7

COMPARISON OF ESTIMATED COSTS
ALL PLANS
(See Appendix C for Detailed Cost Estimates)

Item	Plan A	Plan B	Plan C
Sewer Mains	$107,900	$130,000	$107,900
Pressure Lines	105,800	128,800	197,700
Pump Stations	104,900	106,200	106,500
Treatment Plant	174,700	184,000	456,000
Total Estimated Cost (1)	$493,300	$549,000	$868,100
Minus Sitka's Cost (2)	----	----	347,500
Net Cost (3)	$493,300	$549,000	$520,600
Annual Debt Service (4)	35,980	39,000	36,900
Annual Operating Cost (5)	19,700	19,600	17,050
ANNUAL COST	$ 54,680	$ 58,600	$ 53,950

(1) Includes Engineering and Contingencies

(2) Based on Design Populations - Sitka's share of cost of construction of plant under Plan C equals (8,000 ÷ 10,500) x $456,000

(3) Net cost applicable to collection and treatment of waste from Mt. Edgecumbe

(4) 25-year amortization at 5 percent interest

(5) Operating costs applicable to Mt. Edgecumbe after new facilities are completed (See Table 8)

TABLE 8

ESTIMATED COST OF YEARLY OPERATION & MAINTENANCE

Item	Plan A	Plan B	Plan C	
			Mt. Edgecumbe Share	Sitka's Share
Pump Stations				
Power	$ 790	$ 690	$ 890	$
Maintenance	1,150	1,150	1,150	
Treatment Plant				
Fuel and Power	850	850	720	2,280
Maintenance	800	800	670	2,130
Sewer System				
Labor, Operation & Maintenance	4,000	4,000	4,000	
Employee Salaries	9,600	9,600	7,100	7,300
Transportation				
Pickup, Depreciation Operation & Maintenance	2,500	2,500	2,500	2,500
TOTAL	$19,690	$19,590	$17,030	$14,210
COST ESTIMATE	$19,700	$19,600	$17,050	$14,200

BENEFITS OF COMBINED TREATMENT (PLAN C) TO CITY OF SITKA

For Plan C to be advantageous, it should also be financially attractive to the City of Sitka. Table 9 shows a comparison of capital and annual costs for Sitka under Plan C and with their own separate treatment facilities. These separate facilities for Sitka have been estimated to cost $376,000 for a design population of 8,000 persons. It was assumed that a 30 percent Federal construction grant would be available in both cases to reduce Sitka's net costs.

As shown in Table 9, a joint venture with Mt. Edgecumbe would definitely benefit the City of Sitka by reducing the annual cost of sewage treatment by approximately $4,000 per year. The initial net capital cost to the City would also be reduced approximately $20,000.

DISCUSSION

The interceptor system and treatment facilities for Plan A have the lowest construction costs for Mt. Edgecumbe of the plans studied. Plan C, however, has the lowest annual costs because of savings in operational costs.

Construction of sewage treatment facilities for treating the combined wastes from Mt. Edgecumbe and Sitka as proposed under Plan C shows annual cost benefits to both Mt. Edgecumbe and the City of Sitka.

Construction delays and resultant increased capital cost are important factors in comparing the plans on an annual cost basis. Under Plan C, it is anticipated that considerable delay might be experienced until an agreement for joint treatment was formulated. At the present time, it cannot be anticipated whether the City is interested in a collection and treatment program. No need for such a program has been demonstrated and the City has shown no inclination to proceed on their own. It does appear that, if the City of Sitka is ever to consider sewage collection and treatment facilities, a joint treatment program as outlined under Plan C is to their advantage.

Under Plans A or B, Mt. Edgecumbe could proceed at a fairly rapid rate with a construction program. Under Plan C, there appears to be no doubt that delay would be experienced, while the City developed a collection and financing program and until all details of the joint program were resolved.

TABLE 9

COMPARISON OF ESTIMATED COST
FOR
TREATMENT OF SITKA SEWAGE

Item	Combined with Mt. Edgecumbe[1]	Sitka Alone[2]
Plant Cost	$456,000	$376,000
Minus Mt. Edgecumbe's Share of Cost	108,500	---
Sitka's Estimated Cost[3]	$347,500	$376,000
Minus Federal Grant	104,425	112,800
NET COST[4]	$243,075	$263,200
Annual Debt Service[5]	$ 17,250	$ 18,650
Annual Operating Costs	14,200[6]	16,900[7]
ANNUAL COST	$ 31,450	$ 35,550

(1) Plant having design population of 10,500

(2) Plant having design population of 8,000

(3) Includes engineering and contingencies

(4) Net cost applicable to treatment of wastes from Sitka

(5) 25-year amortization at 5 percent interest

(6) Operating cost applicable to Sitka (See Table 8)

(7) Annual operating cost as itemized below

Annual Operating Costs	
Fuel and Power	$ 2,500
Maintenance	2,300
Full-Time Employee	9,600
Transportation	2,500
Total	$16,900

Increases in construction costs which could be anticipated by a one-year delay would increase the annual cost to Mt. Edgecumbe under Plan C to $55,070 per year. This would then make Plan A the most advantageous for Mt. Edgecumbe. The annual cost differences in favor of Plan A for Mt. Edgecumbe continues to increase for every year Plan C is delayed beyond Plan A.

CHAPTER VI

SUMMARY AND RECOMMENDATIONS

SUMMARY

Plan C, utilizing a conventional primary treatment plant serving both Mt. Edgecumbe and the City of Sitka, appears to be the most advantageous to both Mt. Edgecumbe and the City. Possible delays in construction of Plan C while the necessary City program was developed make the combined plan less attractive to Mt. Edgecumbe for every year of delay. The plan continues to be advantageous to the City of Sitka regardless of the construction schedule.

Plan A, utilizing a separate primary treatment plant for Mt. Edgecumbe near the northwest tip of Japonski Island has the lowest initial net capital costs and competitive total annual costs. This plan should be selected if joint treatment with the City of Sitka cannot be developed.

Because of the uncertainties involved in the negotiations and agreements required under Plan C, a timetable for design and construction is extremely difficult and will be dependent to a large extent on the financial and construction program developed by the City. Shown below, however, is a tentative timetable for construction of Plan A:

Start Final Design	May 1965
Complete Final Design	October 1965
Award Contracts	Early 1966
Complete Construction	December 1966

The above schedule appears to be the most rapid possible and could be delayed or changed by many causes.

RECOMMENDATIONS

On the basis of the foregoing, it is recommended that the following steps be taken:

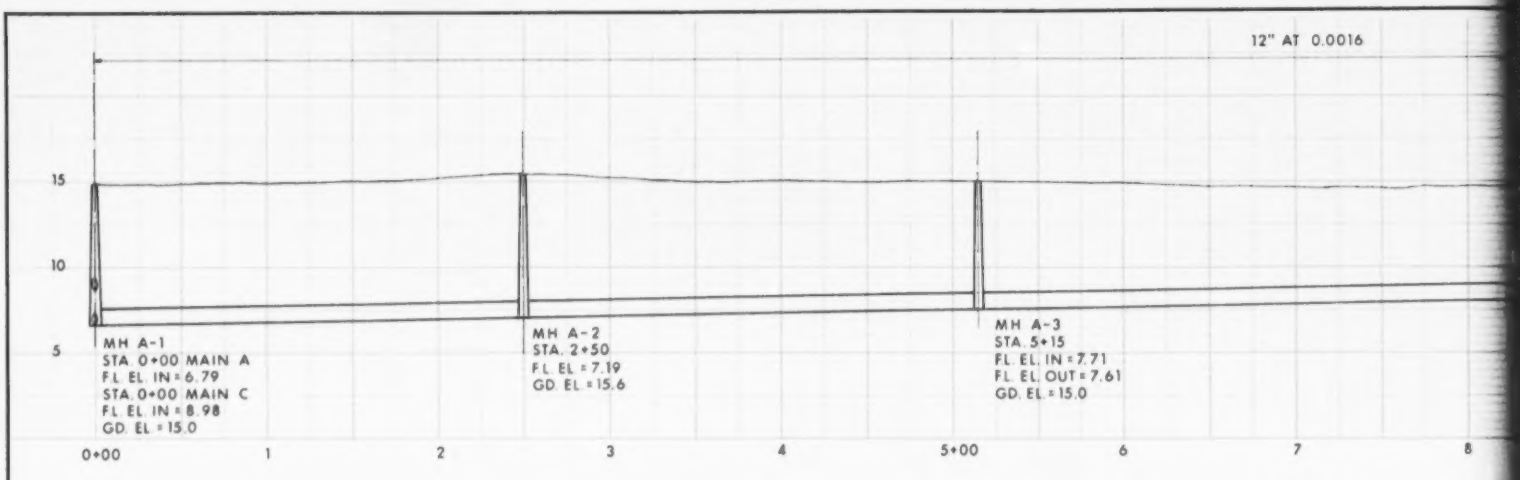
1. Enter into discussions with the City of Sitka concerning combined sewage treatment facilities under Plan C.

2. If such a program can be developed, adopt Plan C as the method of collection and treatment for the Mt. Edgecumbe Federal Complex.

3. If negotiations with the City of Sitka are unsuccessful or if considerable construction delays would be required, adopt Plan A for collection and treatment.

APPENDIX A

SEWER PROFILES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15
10
5
MH A-1
STA. 0+00 MAIN A
FL EL IN = 6.79
STA. 0+00 MAIN C
FL EL IN = 8.98
GD. EL = 15.0
MH A-2
STA. 2+50
FL EL = 7.19
GD. EL = 15.6
MH A-3
STA. 5+15
FL EL IN = 7.71
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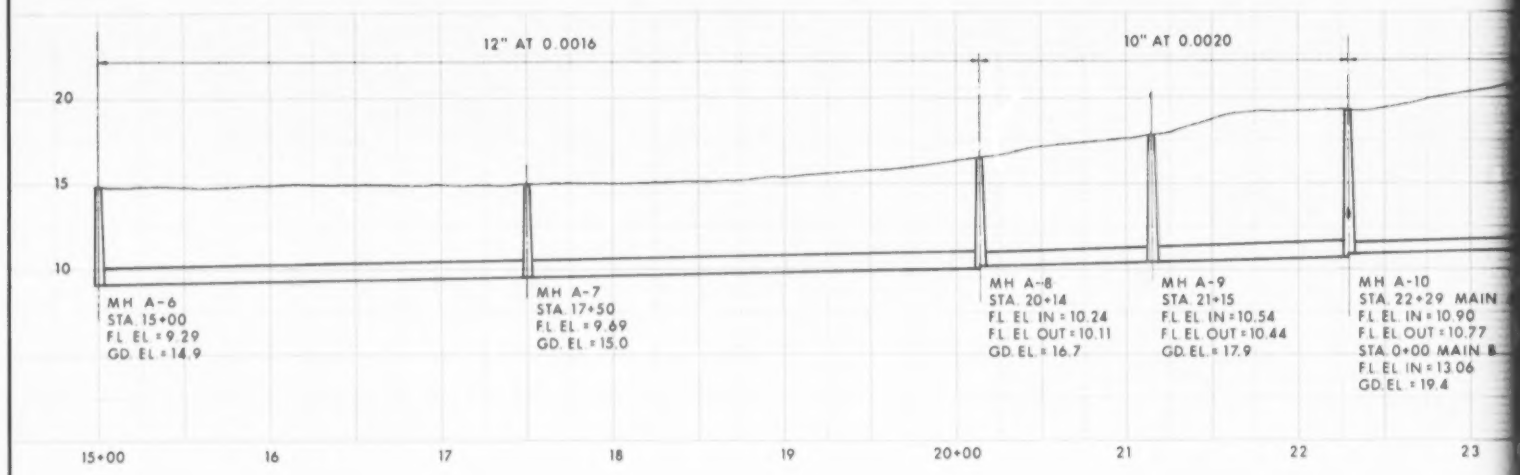
GD. EL = 15.0
0+00
1
2
3
4
5+00
6
7
8

MAIN A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15
10
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STA. 15+00
FL EL = 9.29
GD. EL = 14.9
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STA. 17+50
FL EL = 9.69
GD. EL = 15.0
MH A-8
STA. 20+14
FL EL IN = 10.24
FL EL OUT = 10.11
GD. EL = 16.7
MH A-9
STA. 21+15
FL EL IN = 10.54
FL EL OUT = 10.44
GD. EL = 17.9
MH A-10
STA. 22+29 MAIN
FL EL IN = 10.90
FL EL OUT = 10.77
STA. 0+00 MAIN B
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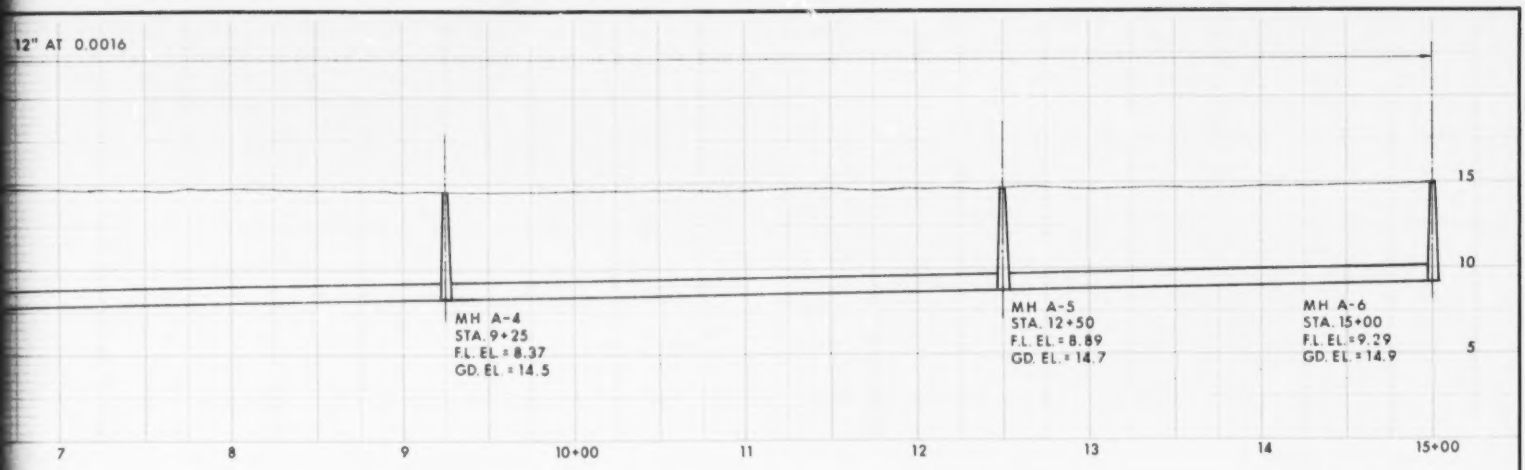
GD. EL = 19.4
15+00
16
17
18
19
20+00
21
22
23

MAIN A



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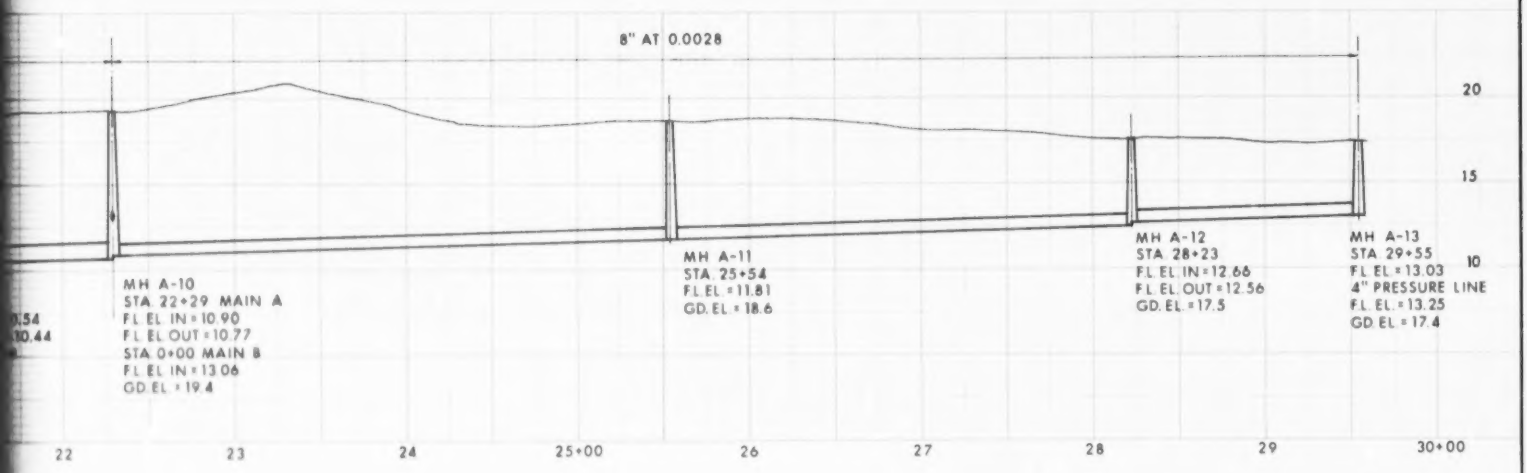
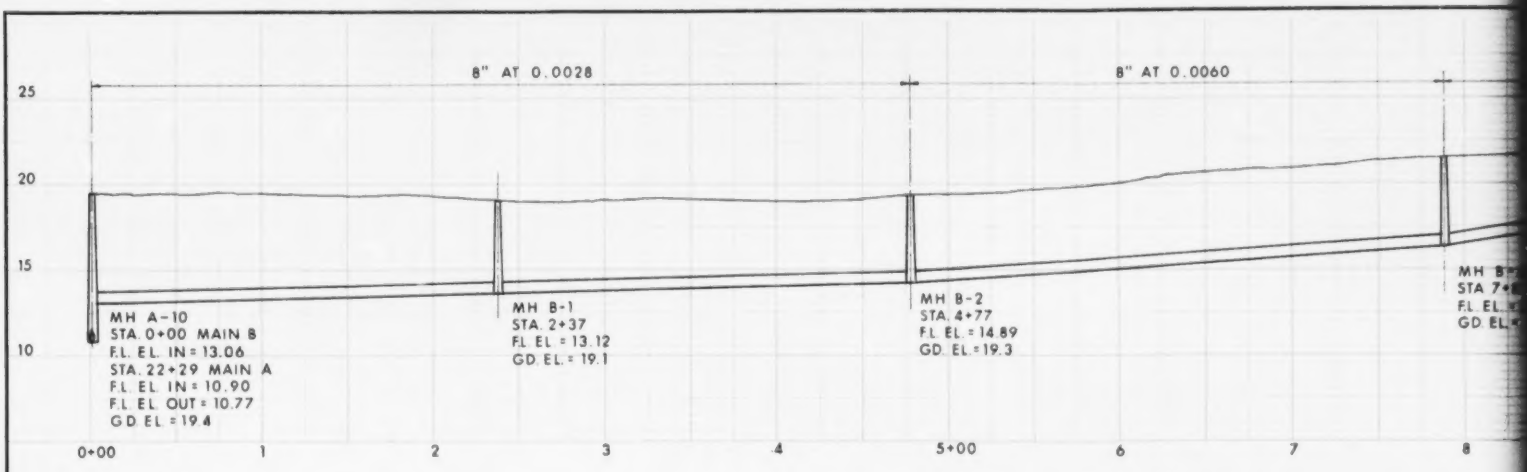


MAIN A

SCALE - HORIZ. 1" = 200'
VERT. 1" = 20'

APPENDIX A-1
MT. EDGECUMBE, ALASKA
SEWERAGE STUDY
PROPOSED SEWERAGE SYSTEM
PROFILES PLAN-A

CORNELL, HOWLAND, HAYES & MERRYFIELD
SEATTLE PORTLAND CORVALLIS BOISE
CH2M



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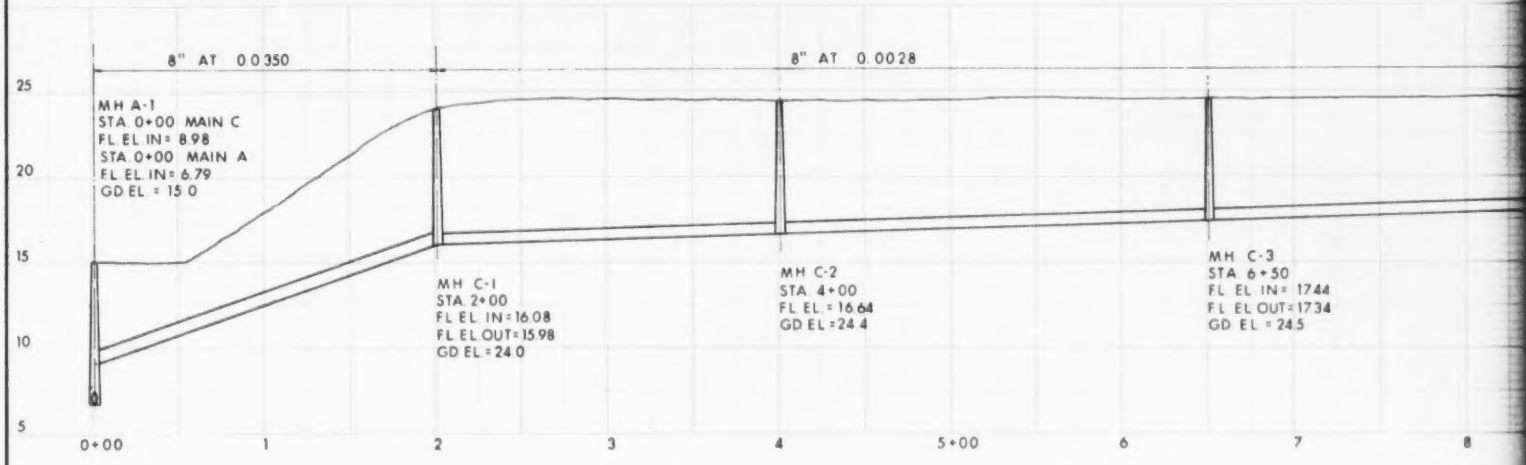
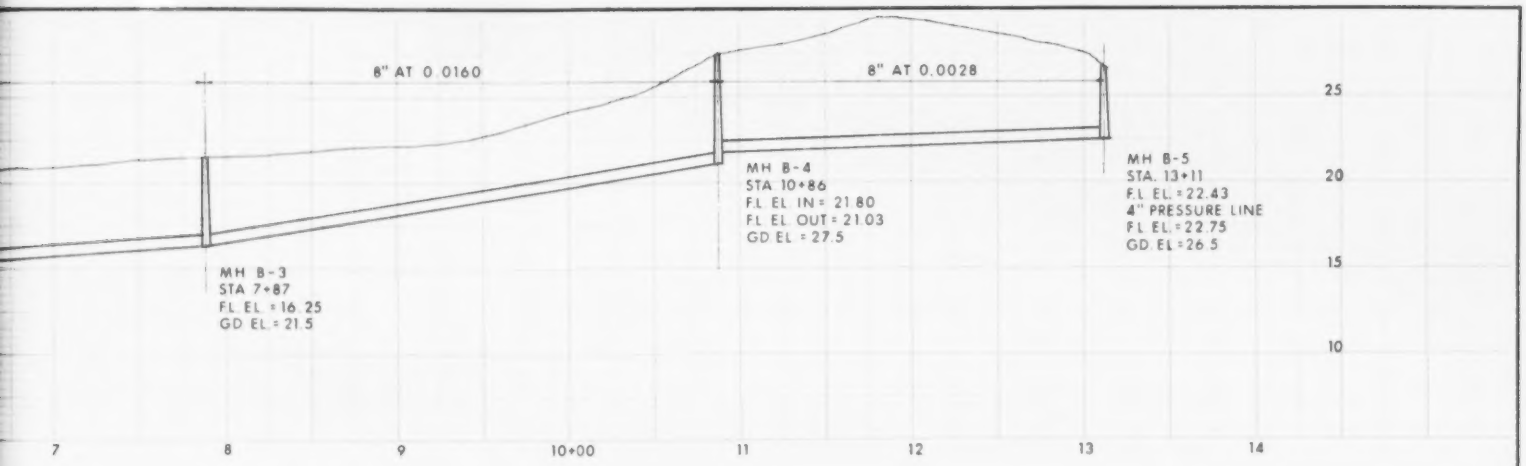


MAIN C

C-3286

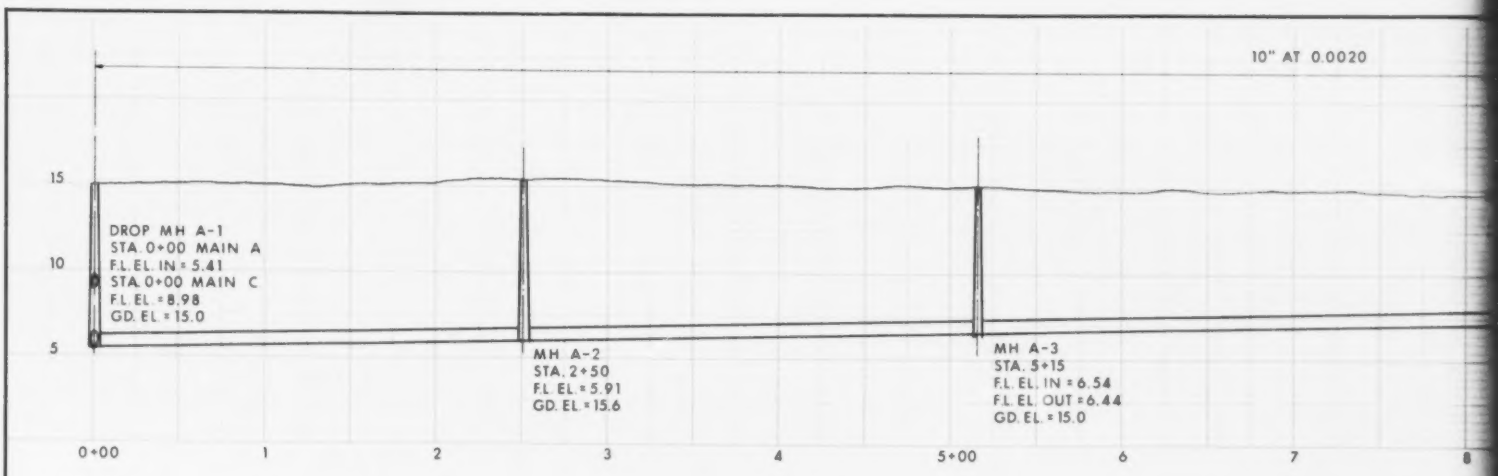


MAIN B

SCALE - HORIZ. 1" = 200'
VERT. 1" = 20'

APPENDIX A-2
MT. EDGECUMBE, ALASKA
SEWERAGE STUDY
PROPOSED SEWERAGE SYSTEM
PROFILES PLAN-A

CORNELL, HOWLAND, HAYES & MERRYFIELD
SEATTLE CORVALLIS BOISE
CH2M



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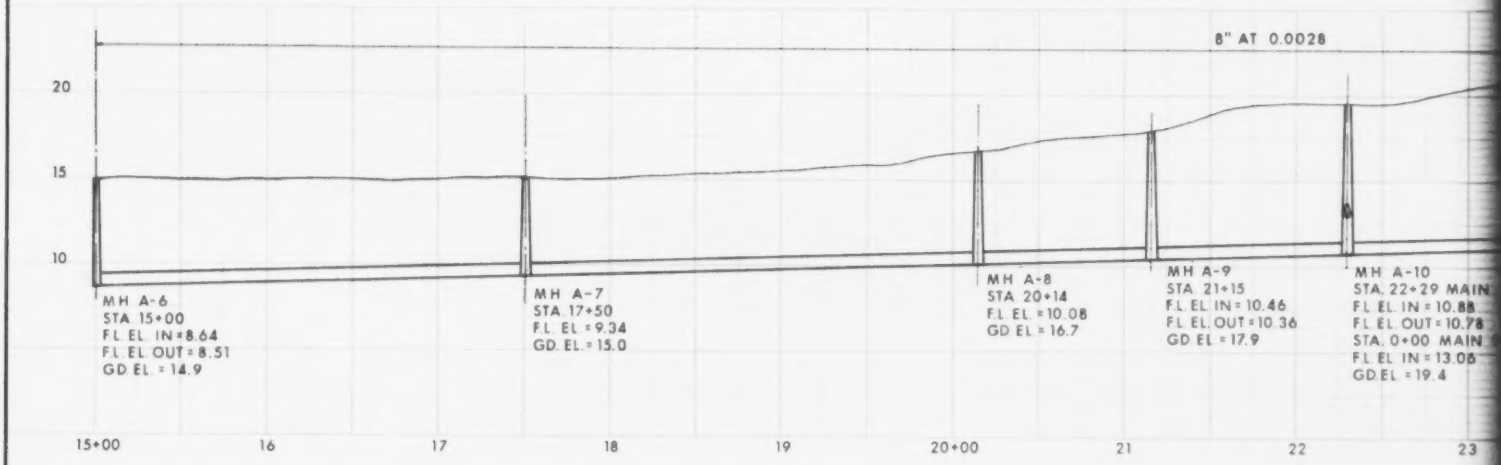

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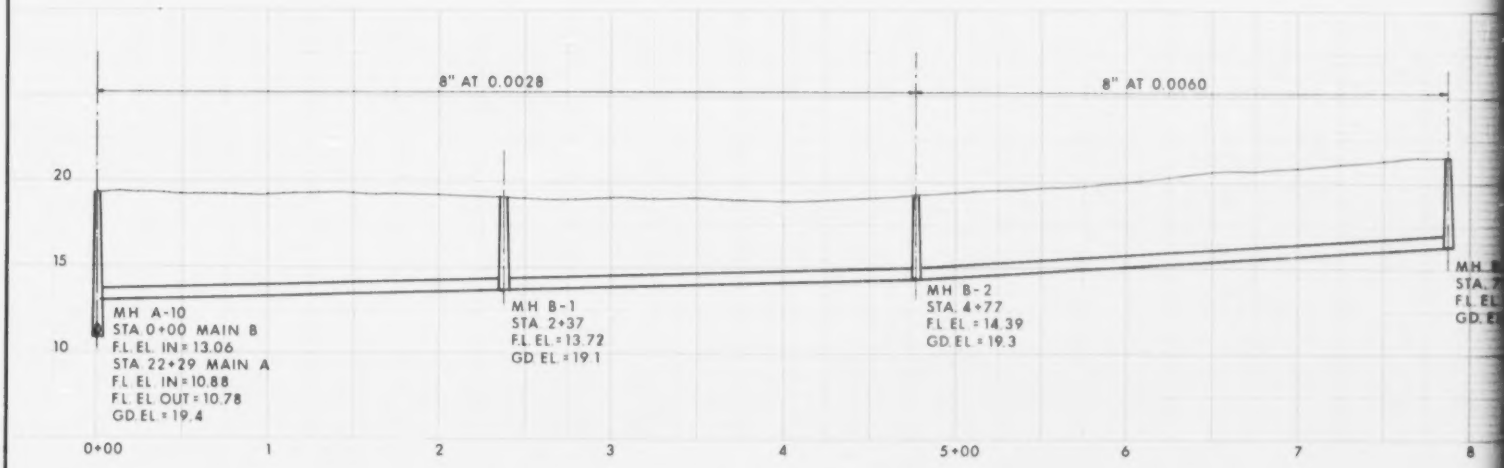

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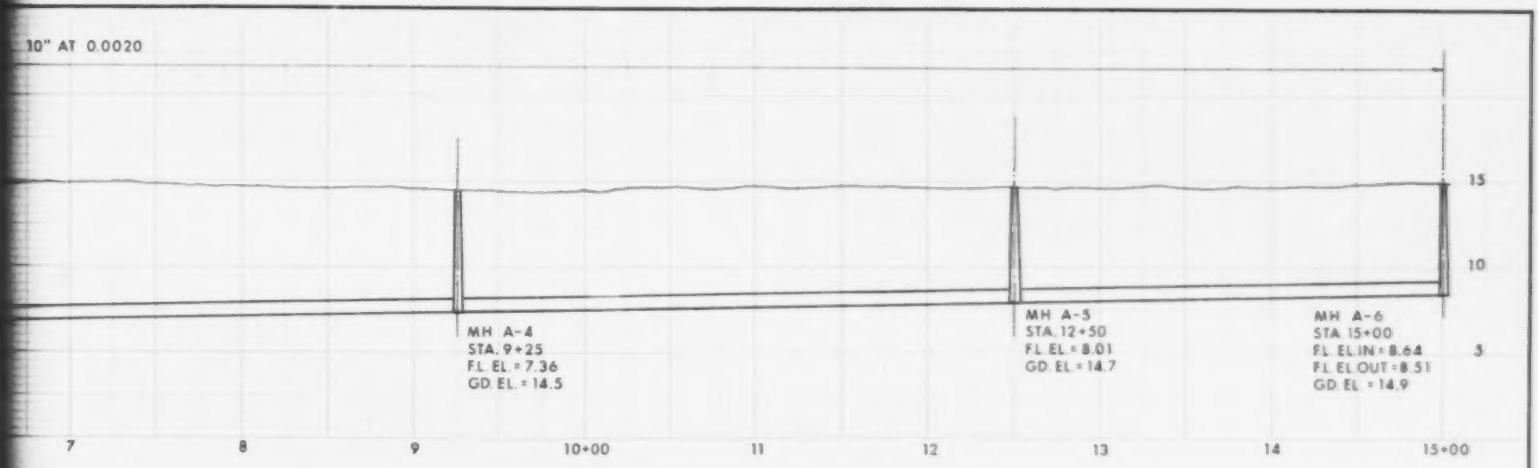
C-3286



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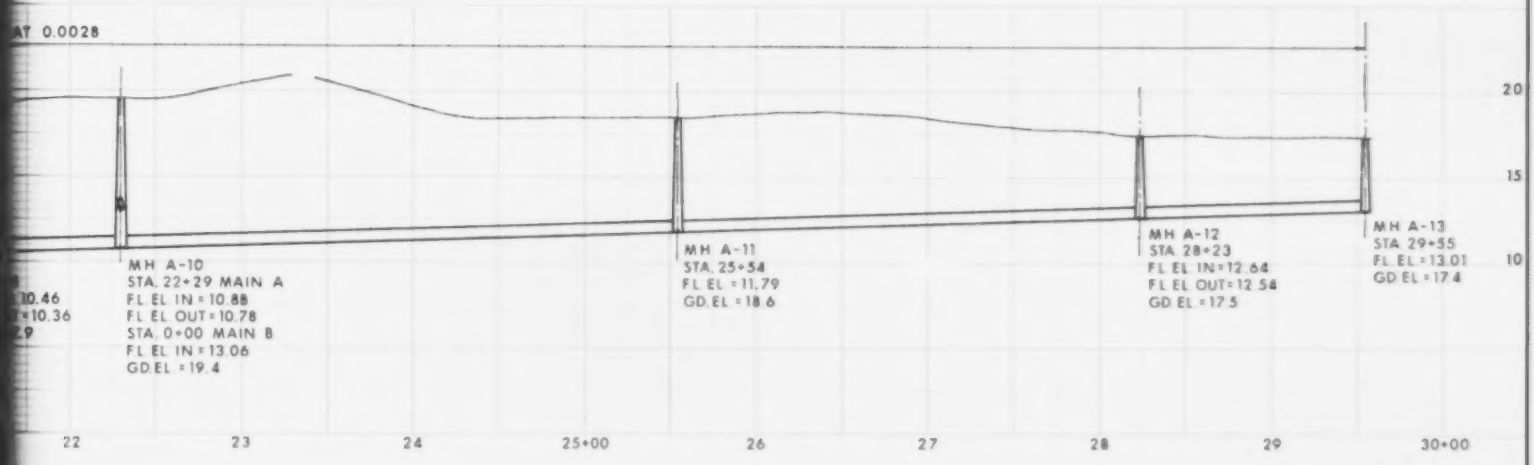
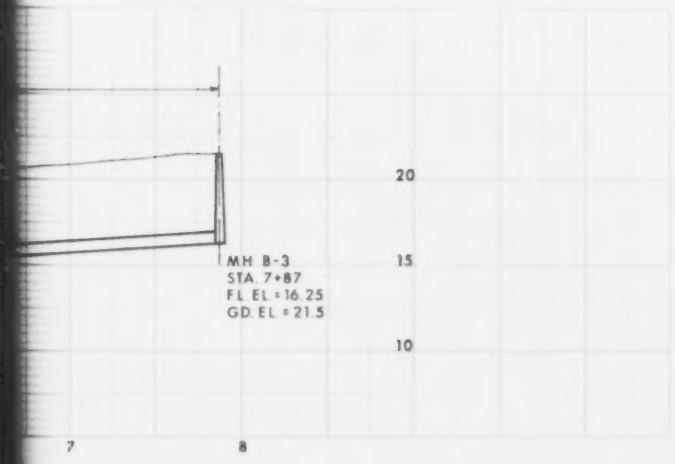


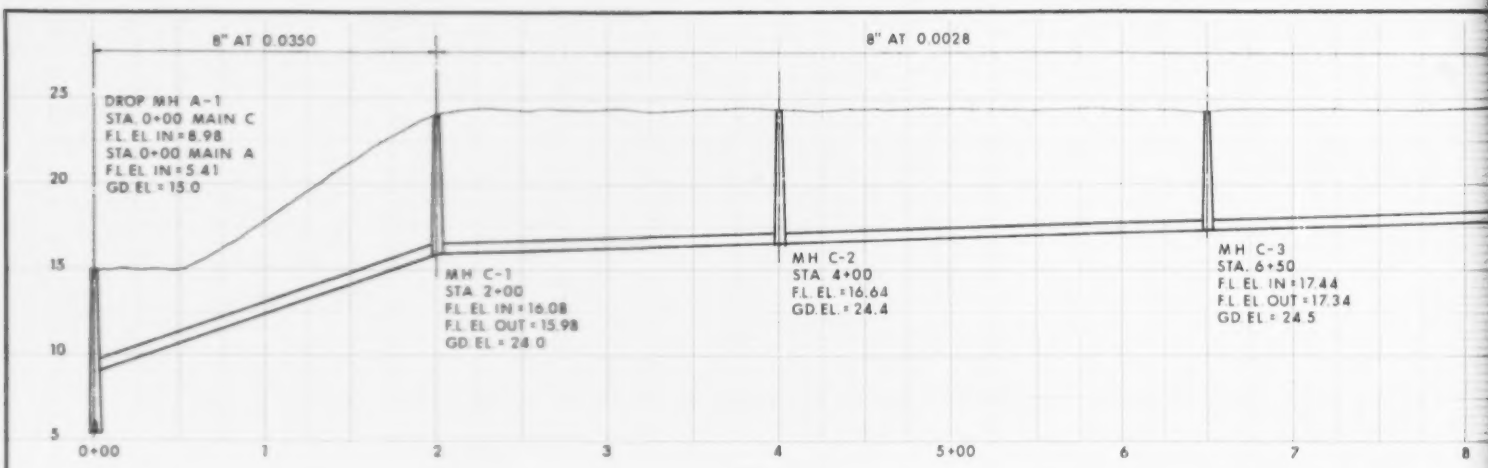
AIN A



SCALE - HORIZ. 1" = 200'
VERT. 1" = 20'

APPENDIX A-3
MT. EDGECUMBE, ALASKA
SEWERAGE STUDY
PROPOSED SEWERAGE SYSTEM
PROFILES PLAN-B

CORNELL, HOWLAND, HAYES & MERRYFIELD
SEATTLE PORTLAND CORVALLIS BOISE
CH2M



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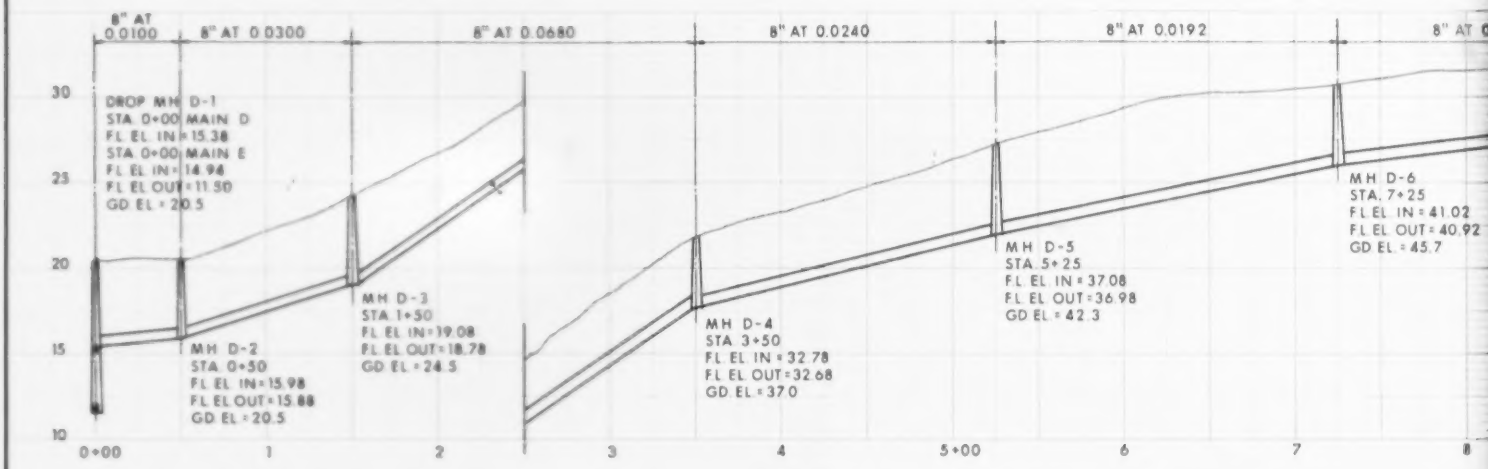

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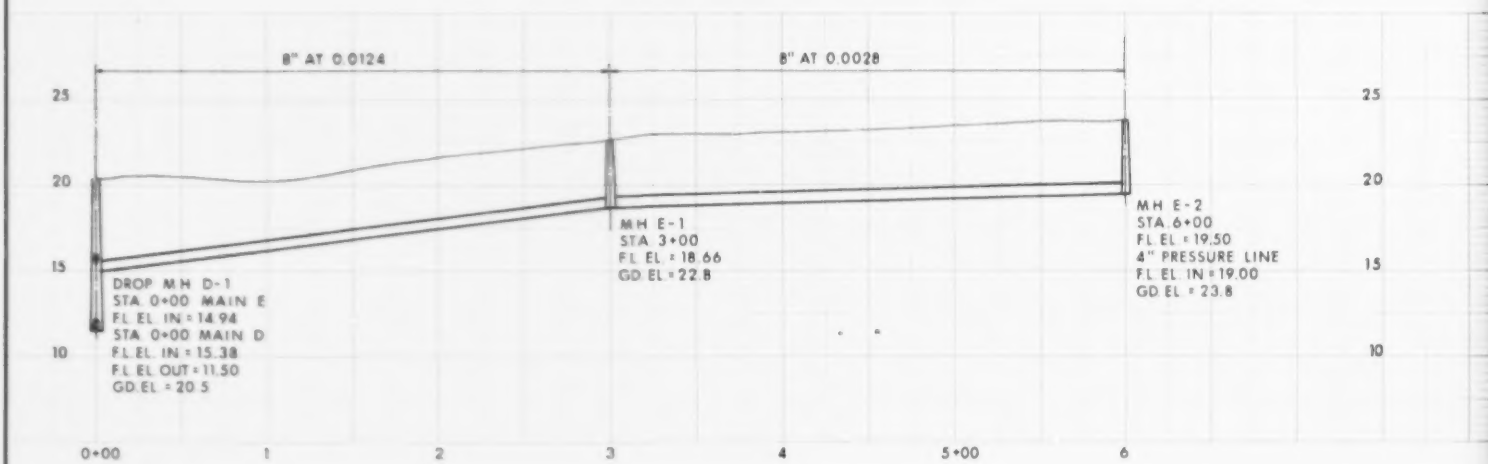

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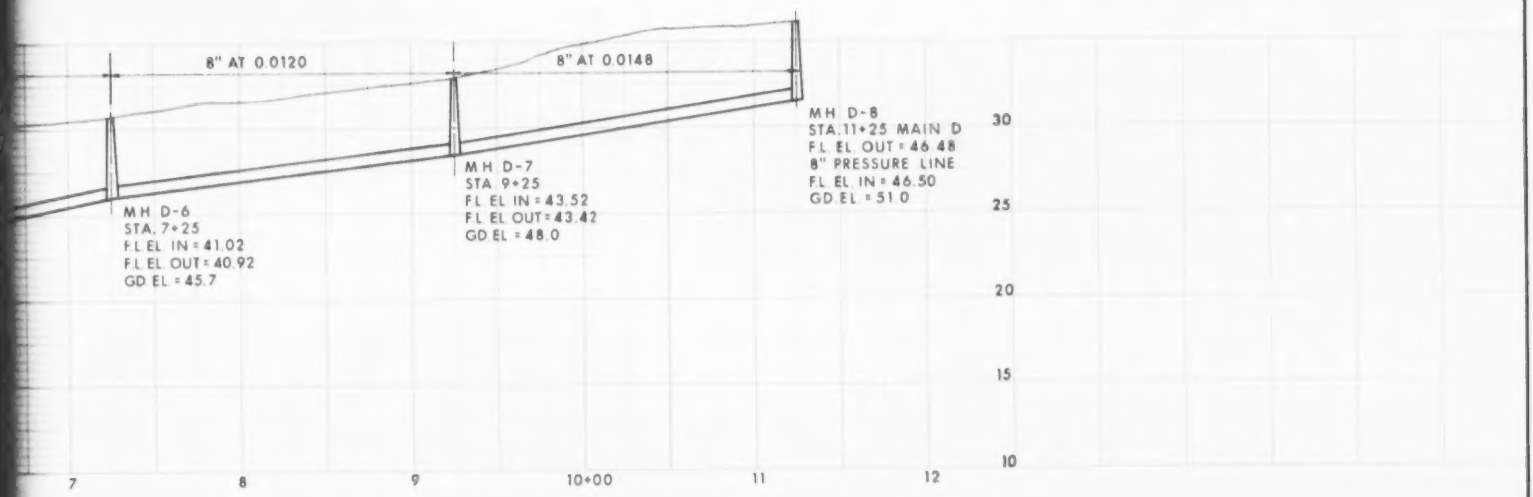

SCALE - HORIZ. 1" = 200'
VERT. 1" = 20'

APPENDIX A-4

MT. EDGECUMBE, ALASKA
SEWERAGE STUDY

PROPOSED SEWERAGE SYSTEM
PROFILES PLAN - B

CORNELL, HOWLAND, HAYES & MERRYFIELD
SEATTLE PORTLAND CORVALLIS BOISE
CH2M

APPENDIX B

LETTERS FROM
DIVISION OF PUBLIC HEALTH
DEPARTMENT OF FISH AND GAME
DIVISION OF AVIATION

PROFESSOR ROBERT O. SYLVESTER

STATE OF ALASKA

WILLIAM A. EGAN, GOVERNOR

DEPARTMENT OF HEALTH AND WELFARE

DIVISION OF PUBLIC HEALTH / SOUTHEASTERN REGIONAL OFFICE
172 SOUTH FRANKLIN — JUNEAU 99801

December 4, 1964

Elmer L. Seegmueller
Cornell, Howard, Hayes & Merryfield
Consulting Engineers
1600 Western Avenue
P. O. Box 411
Corvallis, Oregon

Dear Mr. Seegmueller:

Your letter of October 28, 1964 has been referred to me for reply as Mr. Alter is presently stateside. Please forgive the delay in answering it.

I believe I gave you a copy of our regulations when we met in Sitka, also I note that Mr. Alter sent you information on sewage treatment facilities and our water quality control objectives in re letter last July. I am however, enclosing a copy of our waste disposal regulations, subchapter 2, you will note in Sec. 303, the Minimum Degree of Sewage Treatment that tidal waters are excluded from this provision as each coastal area has its own unique waste disposal requirement and only after detailed engineering study is specific requirements determined.

The recent community growth and expansion of the Mt. Edgecumbe-Sitka area created a need for a study of its sewage disposal problems and we were very happy at learning that your company had been engaged to do such a study.

In as much as your study will be the first detailed study on sewage disposal in this area, we are awaiting the report on the results of your investigation and recommendations before making final determination on what water pollution abatement program to put into effect and what time table will be tied to it.

I am enclosing a copy of a memo from our Seafood Sanitarian, Mr. Charles Jensen, describing the waste disposal of the two fish processing operations in Sitka. Also enclosed is a report of chemical analysis on the water supply at Sitka and Mt. Edgecumbe. Although I have no copy on file, I understand that Hubbel and Waller Engineering Corp., of Seattle, Washington did some work on water and sewage plan for the City

of Sitka in 1958. Perhaps you have this information from Rocky.

We hope this answers your letter satisfactorily and we are looking forward to your report.

Sincerely,

Dr. Joseph O. Rude
Regional Health Officer

By James C. Igoe
James C. Igoe
Regional Sanitary Engineer

JCI:lc
Encl:
cc: J. Alter

STATE OF ALASKA
WILLIAM A. EGAN, GOVERNOR
DEPARTMENT OF FISH AND GAME
OFFICE OF THE COMMISSIONER / SUBPORT BUILDING—JUNEAU

January 12, 1965

Elmer L. Seegmueller
Cornell, Howland, Hayes & Merryfield
Consulting Engineers
1600 Western Avenue
P. O. Box 411
Corvallis, Oregon

Dear Mr. Seegmueller:

Following our telephone conversation of January 8, I checked on the status of your letter dated December 10, 1964. A copy of this letter, which was received on December 14, was sent to our Sitka office on December 16 for first-hand observations and data from the resident commercial fisheries biologist. Because of the intervening holidays, we did not receive his reply until January 7, 1965.

The commercial shellfish resources of Sitka Sound are presently limited to abalones and dungeness crabs. Very limited quantities of commercial abalones are taken by SCUBA divers. Dungeness crabs are taken in limited amounts by standard commercial crab pots. Unfortunately, a statistical breakdown of the catch area for dungeness crabs is not made for a unit as small as Sitka Sound, but it is safe to say that only a very small fraction of the landings of crabs in statistical area 113 (the outside coasts of Chichagof and Baranof Islands) come from Sitka Sound. The total poundage landed in 1963 from all of statistical area 113 was 148,640 pounds.

I am attaching for your information a copy of a brief report on the abalone fishery in the Sitka area. In 1964, a total of 1,090 pounds of commercial abalone meat was landed in Sitka.

Personal use or subsistence fishing for the various species of shellfish present in the waters near the town of Sitka constitutes an important use of these resources. There are no statistics available as to the poundages involved. Major species utilized include dungeness crab, abalone, and clams, while rock scallop and shrimp are of secondary importance. King crabs are known to

occur in the vicinity but, to date, only the most cursory exploratory fishing has been conducted.

Fishery resources of Sitka Sound include salmon, halibut, and herring. Salmon (king and coho) and halibut are taken commercially by trolling gear and long line. Both species of salmon and halibut are also important in the local sport fishery.

Silver Bay and the eastern portion of Sitka Sound constitute one of the major herring spawning areas in Southeastern Alaska. Each spring considerable quantities of herring are taken for use later in the season as salmon and halibut bait. In 1963, 549,300 pounds of herring for bait purposes were taken. Additionally, personal use of the herring spawn has always been important in Sitka, and in recent years there has been growing interest in the commercial utilization of herring spawn.

The dumping of untreated sewage into the receiving waters of Sitka Sound from the Mt. Edgecumbe facility and the City of Sitka apparently has not been in sufficient quantity thus far to constitute a hazard to the many marine vertebrate and invertebrate species inhabiting Sitka Sound. However, the practice of dumping untreated sewage probably constitutes a health hazard. This hazard may well be intensified through the spread of infectious diseases by means of infected invertebrates and certain fishes.

I trust the foregoing material will be helpful for the purposes of your study.

Sincerely yours,

ALASKA DEPARTMENT OF FISH AND GAME

E. S. Marvich, Deputy Commissioner

ESM:EJH:en
Attachment

cc: Amos J. Alter, Dept. of Health & Welfare, Juneau
James Parker, Dept. of Fish & Game, Sitka
E. J. Huizer, Dept. of Fish & Game, Juneau

ABALONE FISHERY

During the year, seven permits were issued to fish abalone for commercial purposes in the Sitka Area. This was about the same number of permits issued in 1962 and again all the permits were requested by SCUBA divers. Most of these permits were obtained by individuals who wanted to do little more than subsistence fish or sell to the local bars. Two persons tried to develop machinery in an effort to lower the costs of preparing the product for market but they found that expenses were too great for their return.

Haliotis kamshatkana is a very small specie of abalone and although they are plentiful in this area, the recovery of abalone meat is small. To date, Sitka Sound and especially the area in the vicinity of Sitka, has been about the only area explored for abalone. At the present time, experienced abalone pickers can gather a feast of legal size abalone by merely using a skiff at low tide along the shore of Halibut Point Road. There is no reason to believe that abalone cannot be found in quantity along outside Baranof and especially outside Chichagof Island. This writer has observed abalone shells in large quantity on the beaches of outside Chichagof.

To date, Haliotis kamshatkana has been the only specie of abalone found in this area. Those abalone taken for commercial purposes generally run from 3½ to 5 inches. Only rarely is one found to be over 5¼ inches. In 1962, a size limit of 3 inches was specified for abalone taken either for

commercial or sport purposes. However, it is not known whether this size limit will allow reproduction for Haliotis kamshatkana before reaching legal size. Studies of this abalone should be made so that the Department can be better prepared, with more realistic management regulations, if a commercial abalone fishery should develop in this area.

STATE OF ALASKA

WILLIAM A. EGAN, GOVERNOR

DEPARTMENT OF PUBLIC WORKS

DIVISION OF AVIATION / 523 - 8th AVENUE — ANCHORAGE 99501

December 14,1964

Re: Sitka Airport Project
Future Sewerage Disposal
Your Ref. No. 3286.0

Mr. Elmer L. Seegmueller
Cornell, Howland, Hayes & Merryfield
P. O. Box 411
Corvallis, Oregon

Dear Mr. Seegmueller:

Please excuse this lengthy delay in answering your letter of October 27th. I was out of town until recently.

In answer to your question concerning height limitations for structures in the area, please be advised of the following: Consider a cross section at any point along the landing strip and perpendicular to the landing strip centerline; commencing at a point 500 feet from centerline, and at the same elevation as the proposed final centerline elevation, strike a line outward and upward on a 7 to 1 slope (7 horizontally - 1 vertically). No structure, or other obstruction, should protrude above that line so established.

The above criterion conforms to recommended data established by the Federal Aviation Agency. We recognize that there may be existing structures which protrude above this imaginary plane; however, in any new construction, we abide by the criterion.

In event that a sewage treatment plant is constructed westerly of the Sitka Airport, please be advised that we would grant access to the Federal Government across State lands for the maintenance and operation of such sewage treatment plant.

In reviewing your sketch of a proposed site for a sewage treatment facility, I note that you are apparently considering an area some 300 feet wide by approximately 900 feet long. The northerly portion of this area embraces what is now the disposal area for the Public Health Service garbage. This northerly area also contains an old seaplane ramp. For your information, we anticipate future development of an amphibious base in the northerly half of the area which you are considering for a sewage treatment plant. We would appreciate receiving from you information pertaining to the spacial requirements for installation of your proposed sewage treatment plant.

You also ask for comments relative to access to the site. The only feasible means of access that we can see is automotive access across the active runway, since access by water would be too inconvenient. There are common safety measures which must, of course, be taken when vehicles operate on or across operational runways. In this case, it would appear that occasional trips to the site could be accommodated without difficulty, especially if the vehicle used is equipped with a radio operating on ground control frequencies.

We will also be glad to offer comments relative to the locating and operating of the sewage treatment plant on the Japonski side of the runway, say at a point near the end of the existing outfalls. The new outfall we are now constructing could then be used to carry the effluent away if the plant operation was not ideal. Such a site appears to offer substantial advantages over a site on the far side of the runway.

I do not foresee any problems in providing a site for a sewage treatment plant, but I do feel that we should have some idea as to the scope of your proposed treatment plant.

Very truly yours,

Lars L. Johnson, Director
Division of Aviation

Eugene R. Leavens
Trunk Airports Engineer

11745 Palatine Ave. N.
Seattle, Wash. 98133
March 15, 1965

Cornell, Howland, Hayes & Merryfield
Consulting Engineers
Logan Building
Seattle, Washington 98102

Re: Mt. Edgecumbe, Alaska Sewerage Study

Gentlemen:

Chapter IV of your report draft on the Mt. Edgecumbe, Alaska Sewerage Study, "Sewage Treatment Considerations and Design Criteria Development" has been reviewed from the standpoint of the outfall location and the following comments and suggestions are tendered:

1. The provision of primary type sewage treatment for Mt. Edgecumbe at a central location is desirable and reasonable. The same is true for the City of Sitka. Combining the two sewer systems for a single disposal facility should be desirable from the standpoint of economies to be realized and because better disposal conditions would probably be obtained with one rather than two separate facilities. Sewage treatment beyond simple sedimentation (primary treatment) is not warranted (with proper outfall location)for the protection of the marine resources or the intertidal area. Herring spawning on the beaches is the principal commercial fishery use of the waters and this should not be jeopardized by the proposed method of sewage disposal. The same is true of other intertidal and water uses.

2. A study of the surface and subsurface current movements in the Japonski Island area and along the Sitka shoreline from north of Watson Pt. to the Blockhouse, under various seasonal conditions of tide and wind, would be beneficial. It is difficult in this instance nowever to justify a comprehensive study of this nature because of the large volume of diluting water available versus the quantity of sewage involved; because of the treatment being provided the sewage; and because proper sewage disposal in this area for the quantities under consideration is largely one of aesthetics. This statement is made with the understanding that the final outfall location selected will not be adjacent to a boat launching area or an area frequented for shellfish collection.

3. The prevailing directions of seasonal winds on Japonski Island are as follows:

Reproduced from best available copy.

Spring - SE & NW
Summer - SW & NW
Autumn - SE & E
Winter - SE & E

Disposal into Whiting Harbor is therefore undesirable because of entrapment of sewage under spring and summer conditions. The most advantageous point for disposal of Mt. Edgecumbe sewage is off the northwest tip of Japonski Island (Plan A), locating the outfall in a northwesterly or northerly direction, depending upon which direction offers the least construction difficulties.

4. Plan A (to discharge off the NW tip of Japonski Island) is thus preferred to Plan B for Mt. Edgecumbe sewage. Watson Point (Plan C) offers the best location for the eventual discharge of the treated sewage from both Sitka and Mt. Edgecumbe, if a joint treatment plant is to be located on the Sitka side of the channel. At either of the two locations, (Plan A or Plan C), the prevailing winds and tidal currents should carry the effluent seaward or parallel to the shoreline under most conditions.

5. The outfall line should extend far enough from shore under the present circumstances to be covered with water under all tidal conditions and to provide a reasonable degree of dilution before the effluent would be set upon the beach during periods of on-shore winds. Taking the outfall off shore to a depth of minus 5 ft. at mean lower low water would provide for continual outfall cover but it would not take the point of discharge very far off shore at either Watson Pt. or the NW corner of Japonski Island. Discharge at the two fathom (minus 12 ft.) depth would seem like a reasonable compromise in this situation.

May the foregoing remarks prove of some value in your report.

Very truly yours,

Robert O. Sylvester
Professor of Sanitary Engineering
University of Washington

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APPENDIX C

DETAILED COST ESTIMATES

SUMMARY OF ESTIMATED CONSTRUCTION COSTS FOR PLAN A

Item	Total Construction Cost		Total Cost[1]	
Sewers				
Main A	$51,004		$66,300	
Main B	18,482		24,000	
Main C	13,518		17,600	
Subtotal		$ 83,004		$107,900
Pressure Lines				
Number 1	$ 4,839		$ 6,300	
Number 2	8,521		11,080	
Number 3	8,846		11,500	
Number 4	5,274		6,860	
Number 5	6,270		8,150	
Number 6	42,210		54,880	
Number 7	5,403		7,030	
Subtotal		$ 81,363		$105,800
Pump Stations				
Number 1	$ 4,500		$ 5,850	
Number 2	14,600		18,970	
Number 3	15,000		19,500	
Number 4	4,500		5,850	
Number 5	15,100		19,630	
Number 6	22,500		29,250	
Number 7	4,500		5,850	
Subtotal		$ 80,700		$104,900
Treatment Plant		$134,410		$174,700
TOTAL		$379,477		$493,300

[1] Includes Engineering and Contingencies (30%)

SUMMARY OF ESTIMATED CONSTRUCTION COSTS FOR PLAN B

Item	Total Construction Cost		Total Cost[1]	
Sewers				
Main A	$50,563		$65,800	
Main B	10,921		14,200	
Main C	13,518		17,600	
Main D	16,818		21,900	
Main E	8,100		10,500	
Subtotal		$ 99,920		$130,000
Pressure Lines				
Number 1	$ 4,839		$ 6,300	
Number 2	6,206		8,060	
Number 3	22,523		29,280	
Number 4	5,274		6,860	
Number 5	42,060		54,650	
Number 6	12,800		16,620	
Number 7	5,403		7,030	
Subtotal		$ 99,105		$128,800
Pump Station				
Number 1	$ 4,500		$ 5,850	
Number 2	14,800		19,240	
Number 3	15,300		19,880	
Number 4	4,500		5,850	
Number 5	20,600		26,780	
Number 6	17,500		22,750	
Number 7	4,500		5,850	
Subtotal		$ 81,700		$106,200
Treatment Plant		$141,570		$184,000
TOTAL		$422,295		$549,000

(1) Includes Engineering and Contingencies (30%)

SUMMARY OF ESTIMATED CONSTRUCTION COSTS FOR PLAN C

Item	Total Construction Cost		Total Cost[1]	
Sewers				
Main A*	$51,004		$66,300	
Main B*	18,482		24,000	
Main C*	13,518		17,600	
Subtotal		$ 83,004		$107,900
Pressure Lines				
Number 1*	$ 4,839		$ 6,300	
Number 2*	8,521		11,080	
Number 3*	8,846		11,500	
Number 4*	5,274		6,860	
Number 5*	6,270		8,150	
Number 6	112,868		146,790	
Number 7*	5,403		7,030	
Subtotal		$152,021		$197,700
Pump Stations				
Number 1*	$ 4,500		$ 5,850	
Number 2*	14,600		18,970	
Number 3*	15,000		19,500	
Number 4*	4,500		5,850	
Number 5*	15,100		19,630	
Number 6	23,700		30,850	
Number 7*	4,500		5,850	
Subtotal		$ 81,900		$106,500
Treatment Plant		$350,800		$456,000
TOTAL		$667,725		$868,100

(1) Includes Engineering and Contingencies (30%)

* Parts of Plan C Identical to Plan A

COST ESTIMATE
SEWAGE TREATMENT PLANT FACILITIES
PLAN A

Item	Amount
Clearing and Grading	$ 2,000
Sewage Grinder and Flow Measurement Basin	7,500
Clarifier - Digester	61,900
Control Building	11,400
Covered Sludge Drying Beds	30,200
Exterior Piping	4,550
Outfall Line	2,700
Fence	3,680
Road Relocation	550
Painting	980
Electrical	4,950
Cleanup and Finish Grading	900
Move-In and Temporary Facilities	1,700
Bond and Insurance	1,400
Subtotal	$134,410
Engineering and Contingencies - 30%	40,290
TOTAL	$174,700

ESTIMATED CONSTRUCTION COSTS
OF
SEWERS FOR PLAN A

MAIN A

Item	Quantity	Unit Cost	Amount
Excavation and Backfill			
0-6 Feet Deep	1,075 lf	$ 3.50	$ 3,762
6-8 Feet Deep	1,305 lf	3.85	5,024
8-10 Feet Deep	575 lf	4.15	2,386
Rock Excavation	852 cy	16.00	13,632
Gravel Base	2,955 lf	0.50	1,478
Pipe			
8" A.C. Class 2400	726 lf	3.30	2,396
10" A.C. Class 2400	215 lf	4.20	903
12" A.C. Class 2400	2,014 lf	5.00	10,070
Manholes			
Standard (6' depth)	13 ea	340.00	4,420
Additional Depth	11 lf	43.00	473
Surface Replacement			
Street Rock (3/4" minus)	65 cy	8.00	520
Concrete (6" depth)	1,980 lf	3.00	5,940
Subtotal			$51,004
Engineering and Contingencies - 30%			15,296
TOTAL			$66,300

ESTIMATED CONSTRUCTION COSTS
OF
SEWERS FOR PLAN A

MAIN B

Item	Quantity	Unit Cost	Amount
Excavation and Backfill			
0-6 Feet Deep	1,050 lf	$ 3.50	$ 3,675
6-8 Feet Deep	261 lf	3.85	1,005
Rock Excavation	400 cy	16.00	6,400
Gravel Base	1,311 lf	0.50	656
Pipe			
8" A.C. Class 2400	1,311 lf	3.30	4,326
Manholes			
Standard (6' depth)	5 ea	340.00	1,700
Surface Replacement			
Street Rock (3/4" minus)	90 cy	8.00	720
Subtotal			$18,482
Engineering and Contingencies - 30%			5,518
TOTAL			$24,000

ESTIMATED CONSTRUCTION COSTS
OF
SEWERS FOR PLAN A

MAIN C

Item	Quantity	Unit Cost	Amount
Excavation and Backfill			
0-6 Feet Deep	115 lf	$ 3.50	$ 403
6-8 Feet Deep	635 lf	3.85	2,445
8-10 Feet Deep	100 lf	4.15	415
Rock Excavation	325 cy	16.00	5,200
Gravel Base	850 lf	0.50	425
Pipe			
8" A.C. Class 2400	850 lf	3.30	2,805
Manholes			
Standard (6' depth)	3 ea	340.00	1,020
Additional Depth	5 lf	43.00	215
Surface Replacement			
Street Rock (3/4" minus)	55 cy	8.00	440
Concrete (6" depth)	50 lf	3.00	150
Subtotal			$13,518
Engineering and Contingencies - 30%			4,082
TOTAL			$17,600

ESTIMATED CONSTRUCTION COSTS OF PRESSURE LINES FOR PLAN A

Item	Quantity	Unit Cost	Amount
Pressure Line No. 1			
4" Pressure Line Complete	465 lf	$ 6.45	$ 2,999
Rock Excavation	100 cy	16.00	1,600
Street Rock Replacement	30 cy	8.00	240
Subtotal			$ 4,839
Engineering and Contingencies - 30%			1,461
TOTAL			$ 6,300
Pressure Line No. 2			
4" Pressure Line Complete	825 lf	$ 6.45	$ 5,321
Rock Excavation	180 cy	16.00	2,800
Street Rock Replacement	40 cy	8.00	320
Subtotal			$ 8,521
Engineering and Contingencies - 30%			2,559
TOTAL			$ 11,080
Pressure Line No. 3			
4" Pressure Line Complete	680 lf	$ 6.45	$ 4,386
Rock Excavation	150 cy	16.00	2,400
Street Rock Replacement	45 cy	8.00	360
230-Foot Bridge Crossing	lump sum		1,700
Subtotal			$ 8,846
Engineering and Contingencies - 30%			2,654
TOTAL			$ 11,500
Pressure Line No. 4			
4" Pressure Line Complete	520 lf	$ 6.45	$ 3,354
Rock Excavation	115 cy	16.00	1,840
Street Rock Replacement	10 cy	8.00	80
Subtotal			$ 5,274
Engineering and Contingencies - 30%			1,586
TOTAL			$ 6,860

PRESSURE LINES FOR PLAN A (Cont'd)

Item	Quantity	Unit Cost	Amount
Pressure Line No. 5			
4" Pressure Line Complete	600 lf	$ 6.45	$ 3,870
Rock Excavation	130 cy	16.00	2,080
Street Rock Replacement	40 cy	8.00	320
Subtotal			$ 6,270
Engineering and Contingencies - 30%			1,880
TOTAL			$ 8,150
Pressure Line No. 6			
10" Pressure Line Complete	2,800 lf	$11.05	$ 30,940
Rock Excavation	600 cy	16.00	9,600
Street Rock Replacement	190 cy	8.00	1,520
Concrete Replacement	50 lf	3.00	150
Subtotal			$ 42,210
Engineering and Contingencies - 30%			12,670
TOTAL			$ 54,880
Pressure Line No. 7			
4" Pressure Line Complete	540 lf	$ 6.45	$ 3,483
Rock Excavation	120 cy	16.00	1,920
Subtotal			$ 5,403
Engineering and Contingencies - 30%			1,627
TOTAL			$ 7,030
Subtotal for All Pressure Lines			$ 81,363
Engineering and Contingencies - 30%			24,437
TOTAL FOR ALL PRESSURE LINES			$105,800

ESTIMATED CONSTRUCTION COSTS OF PUMP STATIONS FOR PLAN A

Item	Amount
Pump Station No. 1 (Submersible Type)	
Excavation and Backfill	$ 340
Manhole and Concrete Slabs	940
Fabricated Metal	270
Piping and Valves	630
Submersible Pump	820
Control	1,500
Subtotal	$ 4,500
Engineering and Contingencies - 30%	1,350
TOTAL	$ 5,850
Pump Station No. 2 (All Steel Factory Built)	
Materials Cost	$ 7,210
Freight	600
Installation Cost	6,790
Subtotal	$14,600
Engineering and Contingencies - 30%	4,370
TOTAL	$18,970
Pump Station No. 3 (All Steel Factory Built)	
Materials Cost	$ 7,375
Freight	600
Installation Cost	7,025
Subtotal	$15,000
Engineering and Contingencies - 30%	4,500
TOTAL	$19,500
Pump Station No. 4 (Submersible Type)	
Costs the same as for Pump Station No. 1	

PUMP STATIONS FOR PLAN A (Cont'd)

Item	Amount
Pump Station No. 5 (All Steel Factory Built)	
Materials Cost	$ 7,485
Freight	600
Installation Cost	7,015
Subtotal	$ 15,100
Engineering and Contingencies - 30%	4,530
TOTAL	$ 19,630
Pump Station No 6 (All Steel Factory Built)	
Materials Cost	$ 10,900
Freight	600
Installation Cost	11,000
Subtotal	$ 22,500
Engineering and Contingencies - 30%	6,750
TOTAL	$ 29,250
Pump Station No 7 (Submersible Type)	
Costs the same as for Pump Station No 1	
Subtotal for All Pump Stations	$ 80,700
Engineering and Contingencies - 30%	24,200
TOTAL FOR ALL PUMP STATIONS	$105,800

COST ESTIMATE
SEWAGE TREATMENT PLANT FACILITIES
PLAN B

Item	Amount
Clearing and Grading	$ 1,500
Sewage Grinder and Flow Measurement Basin	11,000
Clarifier - Digester	62,300
Control Building	11,400
Covered Sludge Drying Beds	30,200
Exterior Piping	4,550
Outfall Line	2,700
Fence	4,800
Access Road and Parking	3,190
Painting	980
Electrical	4,950
Cleanup and Finish Grading	900
Move-In and Temporary Facilities	1,700
Bond and Insurance	1,400
Subtotal	$141,570
Engineering and Contingencies - 30%	42,430
TOTAL	$184,000

ESTIMATED CONSTRUCTION COSTS
OF
SEWERS FOR PLAN B

MAIN A

Item	Quantity	Unit Cost	Amount
Excavation and Backfill			
0-6 Feet Deep	580 lf	$ 3.50	$ 2,030
6-8 Feet Deep	1,460 lf	3.85	5,621
8-10 Feet Deep	915 lf	4.15	3,797
Rock Excavation	920 cy	16.00	14,720
Gravel Base	2,955 lf	0.50	1,478
Pipe			
8" A.C. Class 2400	1,455 lf	3.30	4,802
10" A.C. Class 2400	1,500 lf	4.20	6,300
Manholes			
Standard (6' depth)	12 ea	340.00	4,080
Drop (6' depth)	1 ea	415.00	415
Additional Depth	20 lf	43.00	860
Surface Replacement			
Street Rock (3/4" minus)	65 cy	8.00	520
Concrete (6" depth)	1,980 lf	3.00	5,940
Subtotal			$50,563
Engineering and Contingencies - 30%			15,237
TOTAL			$65,800

ESTIMATED CONSTRUCTION COSTS
OF
SEWERS FOR PLAN B

MAIN B

Item	Quantity	Unit Cost	Amount
Excavation and Backfill			
0-6 Feet Deep	687 lf	$ 3.50	$ 2,405
6-8 Feet Deep	100 lf	3.85	385
Rock Excavation	230 cy	16.00	3,680
Gravel Base	787 lf	0.50	394
Pipe			
8" A. C. Class 2400	787 lf	3.30	2,597
Manholes			
Standard (6' depth)	3 ea	340.00	1,020
Surface Replacement			
Street Rock (3/4" minus)	55 cy	8.00	440
Subtotal			$10,921
Engineering and Contingencies - 30%			3,279
TOTAL			$14,200

ESTIMATED CONSTRUCTION COSTS
OF
SEWERS FOR PLAN B

MAIN C

Item	Quantity	Unit Cost	Amount
Excavation and Backfill			
0-6 Feet Deep	115 lf	$ 3.50	$ 403
6-8 Feet Deep	635 lf	3.85	2,445
8-10 Feet Deep	100 lf	4.15	415
Rock Excavation	325 cy	16.00	5,200
Gravel Base	850 lf	0.50	425
Pipe			
8" A.C. Class 2400	850 lf	3.30	2,805
Manholes			
Standard (6' depth)	3 ea	340.00	1,020
Additional Depth	5 lf	43.00	215
Surface Replacement			
Street Rock (3/4" minus)	55 cy	8.00	440
Concrete (6" depth)	50 lf	3.00	150
Subtotal			$13,518
Engineering and Contingencies - 30%			4,082
TOTAL			$17,600

ESTIMATED CONSTRUCTION COSTS
OF
SEWERS FOR PLAN B

MAIN D

Item	Quantity	Unit Cost	Amount
Excavation and Backfill			
0-6 Feet Deep	1,125 lf	$ 3.50	$ 3,938
Rock Excavation	315 cy	16.00	5,040
Gravel Base	1,125 lf	0.50	563
Pipe			
8" A.C. Class 2400	1,125 lf	3.30	3,713
Manholes			
Standard (6' depth)	7 ea	340.00	2,380
Drop (6' depth)	1 ea	415.00	415
Additional Depth	3 lf	43.00	129
Surface Replacement			
Street Rock (3/4" minus)	80 cy	8.00	640
Subtotal			$16,818
Engineering and Contingencies - 30%			5,082
TOTAL			$21,900

ESTIMATED CONSTRUCTION COSTS
OF
SEWERS FOR PLAN B

MAIN E

Item	Quantity	Unit Cost	Amount
Excavation and Backfill 0-6 Feet Deep	600 lf	$ 3.50	$ 2,100
Rock Excavation	170 cy	16.00	2,720
Gravel Base	600 lf	0.50	300
Pipe 8" A.C. Class 2400	600 lf	3.30	1,980
Manholes Standard (6' depth)	2 ea	340.00	680
Surface Replacement Street Rock (3/4" minus)	40 cy	8.00	320
Subtotal			$ 8,100
Engineering and Contingencies - 30%			2,400
TOTAL			$10,500

ESTIMATED CONSTRUCTION COSTS
OF
PRESSURE LINES FOR PLAN B

Item	Quantity	Unit Cost	Amount
Pressure Line No. 1			
4" Pressure Line Complete	465 lf	$ 6.45	$ 2,999
Rock Excavation	100 cy	16.00	1,600
Street Rock Replacement	30 cy	8.00	240
Subtotal			$ 4,839
Engineering and Contingencies - 30%			1,461
TOTAL			$ 6,300
Pressure Line No. 2			
4" Pressure Line Complete	590 lf	$ 6.45	$ 3,806
Rock Excavation	130 cy	16.00	2,080
Street Rock Replacement	40 cy	8.00	320
Subtotal			$ 6,206
Engineering and Contingencies - 30%			1,854
TOTAL			$ 8,060
Pressure Line No. 3			
4" Pressure Line Complete	2,140 lf	$ 6.45	$ 13,803
Rock Excavation	470 lf	16.00	7,520
Street Rock Replacement	150 cy	8.00	1,200
Subtotal			$ 22,523
Engineering and Contingencies - 30%			6,757
TOTAL			$ 29,280
Pressure Line No. 4			
4" Pressure Line Complete	520 lf	$ 6.45	$ 3,354
Rock Excavation	115 cy	16.00	1,840
Street Rock Replacement	10 cy	8.00	80
Subtotal			$ 5,274
Engineering and Contingencies - 30%			1,586
TOTAL			$ 6,860

PRESSURE LINES FOR PLAN B (Cont'd)

Item	Quantity	Unit Cost	Amount
Pressure Line No. 5			
10" Pressure Line Complete	2,800 lf	$11.05	$ 30,940
Rock Excavation	600 cy	16.00	9,600
Street Rock Replacement	190 cy	8.00	1,520
Subtotal			$ 42,060
Engineering and Contingencies - 30%			12,590
TOTAL			$ 54,650
Pressure Line No. 6			
8" Pressure Line Complete	900 lf	$ 9.40	$ 8,460
Rock Excavation	165 cy	16.00	2,640
Street Rock Replacement	25 cy	8.00	200
Concrete Replacement	500 lf	3.00	1,500
Subtotal			$ 12,800
Engineering and Contingencies - 30%			3,820
TOTAL			$ 16,620
Pressure Line No. 7			
4" Pressure Line Complete	540 lf	$ 6.45	$ 3,483
Rock Excavation	120 cy	16.00	1,920
Subtotal			$ 5,403
Engineering and Contingencies - 30%			1,627
TOTAL			$ 7,030
Subtotal for All Pressure Lines			$ 99,105
Engineering and Contingencies - 30%			29,695
TOTAL FOR ALL PRESSURE LINES			$128,800

ESTIMATED CONSTRUCTION COSTS OF PUMP STATIONS FOR PLAN B

Item	Amount
Pump Station No. 1 (Submersible Type)	
Costs the same as for Pump Station No. 1, Plan A	
Pump Station No. 2 (All Steel Factory Built)	
Materials Cost	$ 7,320
Freight	600
Installation Cost	6,880
Subtotal	$ 14,800
Engineering and Contingencies - 30%	4,440
TOTAL	$ 19,240
Pump Station No. 3 (All Steel Factory Built)	
Materials Cost	$ 7,540
Freight	600
Installation Cost	7,160
Subtotal	$ 15,300
Engineering and Contingencies - 30%	4,580
TOTAL	$ 19,880
Pump Station No. 4 (Submersible Type)	
Costs the same as for Pump Station No. 1, Plan A	
Pump Station No. 5 (All Steel Factory Built)	
Materials Cost	$ 10,400
Freight	600
Installation Cost	9,600
Subtotal	$ 20,600
Engineering and Contingencies - 30%	6,180
TOTAL	$ 26,780

PUMP STATIONS FOR PLAN B (Cont'd)

Item	Amount
Pump Station No. 6 (All Steel Factory Built)	
Materials Cost	$ 8,310
Freight	600
Installation Cost	8,590
Subtotal	$ 17,500
Engineering and Contingencies - 30%	5,250
TOTAL	$ 22,750
Pump Station No. 7 (Submersible Type)	
Costs the same as for Pump Station No. 1, Plan A	
Subtotal for All Pump Stations	$ 81,700
Engineering and Contingencies - 30%	24,500
TOTAL FOR ALL PUMP STATIONS	$106,200

COST ESTIMATE
SEWAGE TREATMENT PLANT FACILITIES
PLAN C

Item	Amount
Clearing and Grading	$ 4,700
Grit Basin	21,100
Sewage Grinder and Parshall Flume	23,000
Clarifier	54,400
Primary Digester	43,300
Secondary Digester	53,200
Control Building	82,000
Sludge Loading Dock	3,100
Exterior Piping	18,500
Outfall Line	10,000
Fence	6,100
Roads and Parking	1,500
Electrical	21,100
Cleanup and Finish Grading	2,000
Move-In and Temporary Facilities	3,300
Bond and Insurance	3,500
Subtotal	$350,800
Engineering and Contingencies - 30%	105,200
TOTAL	$456,000

ESTIMATED CONSTRUCTION COSTS
FOR
SEWERS, PRESSURE LINES, AND PUMP STATIONS
PLAN C

Sewers (Same as for Plan A)

Item	Amount
Main A	$ 51,004
Main B	18,482
Main C	13,518
Subtotal	$ 83,004
Engineering and Contingencies - 30%	24,896
TOTAL	$107,900

Pressure Lines

Item	Quantity	Unit Cost	Amount
Pressure Line No. 6			
10" Pressure Line Complete	6,150 lf	$11.05	$ 67,958
Rock Excavation	920 cy	16.00	14,720
Street Rock Replacement	130 cy	8.00	1,040
Concrete Replacement	450 lf	3.00	1,350
Sitka Channel Crossing	lump sum		27,800
Subtotal			$112,868
Engineering and Contingencies - 30%			33,912
TOTAL			$146,780
Pressure Lines Nos. 1, 2, 3, 4, 5, and 7 (Same as for Plan A)			
No. 1			$ 4,839
No. 2			8,521
No. 3			8,846
No. 4			5,274
No. 5			6,270
No. 7			5,403
Subtotal (1, 2, 3, 4, 5, and 7)			$ 39,153
Engineering and Contingencies - 30%			11,767
TOTAL			$ 50,920

SEWERS, PRESSURE LINES, AND PUMP STATIONS (Cont'd)
PLAN C

Pressure Lines (Cont'd)

	Amount
Subtotal for All Pressure Lines	$152,021
Engineering and Contingencies - 30%	45,679
TOTAL FOR ALL PRESSURE LINES	$197,700

Pump Stations

Item	Amount
Pump Station No. 6 (All Steel Factory Built)	
Materials Cost	$ 11,400
Freight	600
Installation Cost	11,700
Subtotal	$ 23,700
Engineering and Contingencies - 30%	7,150
TOTAL	$ 30,850
Pump Stations Nos. 1, 2, 3, 4, 5, and 7 (Same as for Plan A)	
No. 1	$ 4,500
No. 2	14,600
No. 3	15,000
No. 4	4,500
No. 5	15,100
No. 7	4,500
Subtotal (1, 2, 3, 4, 5, and 7)	$ 58,200
Engineering and Contingencies - 30%	17,450
TOTAL	$ 75,650
Subtotal for All Pump Stations	$ 81,900
Engineering and Contingencies - 30%	24,600
TOTAL FOR ALL PUMP STATIONS	$106,500